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OBSERVATIONS

ON

VITRUVII DE ARCHITECTURA LIBRI DECEM

WITH SPECIAL REGARD TO THE TIME AT WHICH
THIS WORK WAS WRITTEN

By J. L. USSING, Ph.D., LL.D. [*Hon. Corr. M.*]

LATE PROFESSOR OF GREEK AND LATIN IN THE UNIVERSITY OF COPENHAGEN

[*Translated from the Danish, and carefully Revised by the Author*]

THE ROYAL INSTITUTE OF BRITISH ARCHITECTS 1834
INCORP. 1837 1887
VSVI VRBIVM CIVIVM DECORI

LONDON
9, CONDUIT STREET, HANOVER SQUARE, W.
1898

Price Two Shillings and Sixpence.

The Council of the Institute, while thinking it desirable to print this translation, take no responsibility for any of the conclusions arrived at.

The Edition of Vitruvius upon which Dr. Ussing's treatise is based is that of Rose and Müller-Strübing (*Leipsic* 1867); *but the references also apply to Schneider's edition. When chapters are noted by two numbers—e.g.* "9 (8)"—*the former refers to the edition of Rose, and the latter to that of Schneider.*

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This work is called in the manuscripts *Vitruvii de architectura libri decem.* In the extract of it by M. Cetius Faventinus, the author is called Vitruvius Polio.

When this *opus* was first printed, towards the end of the fifteenth century, it created an immense sensation; and very justly so. An author who, according to his own saying, was a contemporary of Cæsar and Augustus, provided us with a manual of ancient architecture, a valuable help to the understanding of the numerous partly preserved and highly admired remains of antiquity, and a guide to those who might want to copy them; and this at a time when Renaissance architecture was in its highest glory, and when all efforts tended towards the revival of antiquity. Learned men as well as architects pounced upon him and made use of him; he became a teacher in architecture to the new time. And his authority lasted for centuries; only in the present century it has begun to fade. We do not want him any longer, as a closer knowledge of the best monuments of classical antiquity has presented us with better models and better teachers. Now we venture to criticise him; we see his faults, and we do not believe in him implicitly; as our eyes begin to open, we discover one shortcoming greater than the other. Instead of an excellent architect from the most glorious Roman period, we find a shallow-minded, ignorant man who boasts of knowledge which he does not possess; we may even discover that he is not the man he pretends to be. But before entering on a closer explanation of this statement, which is meant to be the essence of this pamphlet, I must declare that I do not at all consider the work in question as useless or valueless. It is unquestionably a work which may be of great use if applied critically and with caution. For there is not the slightest doubt that we have before us an ancient author, though not from the time specially designated as classical, a man who had seen a good deal we cannot see, and above all; a man who had sources which we have not. Therefore it would be of great importance to know what these sources were, and how he used them; nor is it an idle question to ask at what time he lived. This question is of importance not only to archæology, but also to the study of languages. We find in his language peculiarities which we should not be surprised to see at the close of antiquity, when the Latin tongue was approaching its dissolution, and its transition to the Romance languages. Now if such peculiarities already appear in an author of the time of Augustus, the only possible explanation is that they might have belonged to the lower uneducated classes, and that those classes in the time of Augustus had spoken the same language which was spoken by all Romans three to four centuries later. This again leads to the conclusion that even the authors of the golden age did not write the real living Roman tongue, but a conventional literary language. However, on this point we are not justified in referring to Vitruvius, for this author did not live at the time of Augustus, a fact which, I hope, will be easily seen from what follows. It is less easy to state the exact time at which he lived; only the *terminus post quem* can be fixed with some certainty. We cannot wonder that the author, pretending to belong to an earlier period, does not willingly betray himself; nevertheless it would be strange if we could detect no signs which betray him, either in his language, or in the facts he reports or alludes to.

Earlier scholars did not doubt the author's own statement that he had been a military architect under Cæsar, and that his writings dated from the time of Augustus. He appeared to possess considerable technical knowledge, and ever since the beginning of the Renaissance he had been a source from which all kinds of information had been drawn. Now if it happened to some expert in Latin literature to be scandalised at his barbarous language, this shortcoming was accounted for by his being a simple workman without literary education. That the book was as defective from an architectural as from a technical point of view, most readers had not sufficient knowledge to see. Only when Hirt had constructed his history of architecture founded on the statements of Vitruvius, the critical eye of the professional man was opened. A man with a penetrating mind, and with philological as well as technical knowledge, C. F. L. Schultz, councillor of state in Wetzlar, undertook to examine the subject more closely. In a letter to Goethe of May 6, 1829 (printed in Welcker and Näke's *Rheinisches Museum*, vol. iv. 1836), he communicates his views to this friend, and for one thing proves clearly that Frontinus has drawn no information from Vitruvius, the latter being full of nonsense and mistakes—in fact an ignorant humbug, while the former is a competent professional authority. It was his intention, in which he was encouraged by Goethe, to explain his views more in detail, and also to prove that Pliny had not gathered his knowledge from Vitruvius or written extracts from his work, but that Vitruvius had used and spun out Pliny. However, the work of Schultz was not finished and published during his lifetime. He imparted his ideas to his nearest friends, and Osann at least was inclined to adopt them (comp. *Rhein. Mus.* vol. v. (1837) p. 617 f.). But in several respects Schultz went too far. He denied not only the genuineness of Vitruvius, but also that of Pomponius Mela—a view in which we cannot agree; and he thought that the so-called Vitruvius was written by archbishop Gerbert, who in 999 became pope under the name of Sylvester II, an opinion which is already refuted by the fact that the oldest MS. of the work, codex Harleianus, was written in the 9th century. Therefore philologists, who, as a rule, were devoid of technical and architectural knowledge, took no notice of Schultz's observations, which hitherto had only appeared occasionally, though—in spite of their brevity—they were so conclusive that no further evidence was needed. H. Brunn mentions him in a programme of the university of Bonn, 1856: *De auctorum indicibus Plinianis*, p. 57 ff., and thinks to have done with him in quoting some parallel passages by Pliny and by Vitruvius, without suspecting that to a really critical reader his quotations offer the best proofs that Schultz was right. In the same year (1856), Schultz's posthumous work, published by his son, appeared under the title: *Untersuchungen über das Zeitalter des römischen Kriegsbaumeisters Marcus Vitruvius Pollio von C. F. L. Schultz, Geheimen Ober-Regierungs-Rath, herausgegeben von Otto Schultz, Ingenieur Lieutenant.* Though the author did not live to give the finishing touch to his work, he has done enough to decide the question. He proves clearly that the Vitruvius we read was neither a real architect nor a technical expert, but a closet philosopher who pretended to be what he was not; further, that he did not live at the time of Augustus; Schultz thinks he may be put down to the time of Constantine the Great, or rather to that of Theodosius. But "habent sua fata libelli." This excellent booklet appeared in a too modest form, a small closely printed pamphlet of 55 pages octavo; it is almost forgotten in Germany; (I have mentioned it in my university programme of 1876: *About the Greek and Roman Houses*, p. 3). It does not seem to have been known by Detlefsen, the editor of Pliny, who in *Philologus*, 1872, wrote a tolerably long essay: "Vitruvius als Quelle des Plinius," in which he tried to bear out in detail the relation between the two authors which Brunn had indicated, in order to prove that the general opinion about the matter was the correct one; Teuffel dismisses it with a short notice in his *Geschichte der römischen Litteratur*, 1870, and it is alluded to in the same manner in the three following editions published by Schwabe after the author's death; but in the fifth edition (1890) Schultz's pamphlet is not named at all. So it seems necessary to take up the question again.

I.

The time of Augustus was the golden age of Roman literature. The public was highly educated, and the authors had the gift of giving a peculiar stamp of beauty to their writings. In literature as in art we constantly feel ourselves standing at one of the culminating points of ancient civilisation. Now, when we take into our hands the ten books *De Architectura* by Vitruvius, and learn that they pretend to be written at that period, we feel struck and cannot refrain from doubting whether this is really so. Neither language, style, nor thoughts seem to agree with this statement, and nobody would have thought of attributing the work to that time, if the author had not himself stated it as a fact. Then it was thought that the surprising phenomenon might be explained by the circumstance that he was a practical man without literary education; belonging to the lower class, it was only natural that he should speak the language of his equals and be unable to write like a scholar. In support of this opinion some lines have been quoted from the first book (chap. 1, 17) in which he asks the reader's pardon for any sin against the rules of grammar, and says that he does not write like a philosopher of the highest rank, a rhetorician, or a grammarian, but like an architect (" non uti summus philosophus nec rhetor disertus nec grammaticus summis rationibus artis exercitatus sed ut architectus his litteris imbutus hæc nisus sum scribere "). Nevertheless half the work is taken up by philosophical and physical reflections, and it is this same—according to his own saying uneducated—man who quotes a large number of Greek authors which the scholars of our time do not even know by name; who enters upon learned conversations with his guests (VIII, 4, 25), and, in the preface of Book VI (§ 4), "thanks his parents for having taught him an art which could not be acquired without knowledge of literature and of the humanities. After having received such a careful education by parents and teachers, he enjoys writing about matters of learning and of art, and in this way has filled his mind with such treasures that he feels it unnecessary to acquire more than he possesses, declaring that the greatest wealth consists in feeling no want."

We see the man boasts of his high education; he does not want to be considered an ignorant artisan, and if he apologises to the reader for possible grammatical blunders, it is only an attempt to defend himself against such complaints as his uneasy conscience makes him anticipate. Evidently he had not the remotest idea how innumerable these complaints would be.

It is said by a critic in the *Athenæum* of January this year (1898) "that a skilled reader will receive no greater impression of uncouthness from the Latin of Vitruvius than he will receive from the Latin of many parts of Varro's *De Re Rustica.*" There is indeed an immense difference: Varro was a man of real learning and culture, nevertheless he wrote as he talked. Vitruvius does not care to write as he talks, he takes pains to write like a learned man of the time of Augustus, but he fails, as such attempts generally do if not undertaken by a master; the style and the spoken language of his own time often transpire. We shall call attention to some of his most prominent linguistic peculiarities. Our remarks do not claim to exhaust the matter: they may rather be called sporadic; in reading an author, the eye gets gradually so accustomed to his language and style that it is dulled to his characteristics. Among special essays on Vitruvius I have only made use of one, which, in spite of the difference in the general view of the author, has been very useful to me, namely: Praun, *Bemerkungen zur Syntax des Vitruv*, Bamberg 1885. I also owe important contributions to my friends Dr. O. Siesbye and Professor J. L. Heiberg.

One of the peculiarities which occur especially in the authors of the later period of the empire, where they wanted to write nicely and philosophically, is the frequent use of abstract nouns, even in the plural. So also in Vitruvius. Among abstract nouns which appear only in his writings I will mention *ignotitia* III præf. 3, *indecentia* VII, 5, 6, *pervolitantia* IX, 7 (6), 1, *nascentia* IX, 7 (6), 2, *crescentiæ* IX, 9 (8), 6–7, *commensus* = *mensura* I, 3, 2, I, 7 extr., III, 1, 3, V præf. 2, VI præf. extr. Striking plurals are *conscriptiones* V præf. 2, VII præf. 1, *eruditiones* I, 1, 17, II, 1, 8, *scientiæ* I, 1, 17, III præf. 1 et 3, IX, 7 (6), 3, *sollertiæ* VII præf. 10 &c. &c. And sometimes these abstract nouns retain so much of their verbal character that the author finds it sufficient to add only *est* instead of *factum est*, as in I, 3, 2: "cum fuerit fundamentorum ad solidum depressio;" I, 5, 1: "cum erit mœnium conlocandorum explicatio."

One of the words frequently occurring in Vitruvius is *symmetria*; according to Nohl's index, it is found about a hundred times. At the time of Pliny this word is still a stranger to the Latin language, comp. *Hist. Nat.* XXXIV, 65: *non habet Latinum nomen symmetria.* Pliny no doubt appreciated his own Latin style, but he does not carry his purifying tendencies so far as to exclude every foreign word, if it was generally adopted in the language; his apology testifies to the fact that such was not the case with *symmetria.*

Not unfrequently words are found in a different connection and different signification from that of the classical authors. Thus *notitia* in the sense of "renown" III præf. 1, VI præf. 4, *ponere* "put forth" III præf. extr., and *anteponere* "put forth at first" II præf. 5; *dignum est* for *operæ pretium est* II, 7, 4: "si prope urbem essent, dignum esset, ut ex his officinis omnia opera perficerentur;" similar things are quoted from Vopiscus, Lactantius, and Augustinus; *necessitate* = *necessario* X, 2, 1.

In a few instances *videtur* is meant to signify *placet*: V, 10, 4: "magnitudines balinearum videntur fieri pro copia hominum;" VIII, 7 (6), 11: "itaque minime fistulis plumbeis aqua duci videtur." In other places Vitruvius correctly adds *oportere*, so that the omission might perhaps rather be called a peculiarity of style in the author, as in II, 1, 8: "primo volumine putavi . . . exponere."

Shall we consider it as merely accidental that the word *narrare*, which was generally used during the classical period, does not occur at all in Vitruvius? ("narratio," which is found in Rose's edition II præf. 3, is a mistaken correction of "ratio" in the manuscripts); Vitruvius only uses *memorare*; or that the verb *ire* (without prefix) appears but once, whereas we frequently find *vadere* which in Cicero means "to depart," and only in Virgil and Ovid signifies "to go," thence entering into the later prose and subsequently into the Romance languages, entirely superseding the genuine Latin word? Is it accidental that, after the fashion of more recent authors, Vitruvius frequently transcribes the simple future by *erit ut*? e.g. I, 1, 10: "erit ut uterque liberetur." V, 12, 6: "ita erit uti possit turris insuper ædificari." VI, 6, 11: "tunc erit ut . . . fiant." Dräger, *Hist. Synt.* 2, p. 267, quotes a similar example from Apuleius, *Met.* II, 3: "numquam erit ut non apud te devertar."

With regard to the comparison of adjectives, we often find the comparative unnecessarily emphasised: *maxime facilius* I, 1, 4, *maxime tutiores* I, 5, 5, *maxime utiliores* II, 3, 2, *quo magis ex meliore vino parabitur* VII, 10, 4, *potius digniores* VI præf. 6. Comp. *nimium penitus* VIII, 7, 14. Similarly Lactant. *Instit.* I, 21, 10: *maxime dulcior.* Commodian, *Apolog.* 5: *plus levior.* Sulpicius Severus, *Chron.* II, 46, 5: *plus iusto inflatior.* About the use of the preposition *ab* in the comparison, see immediately below.

The superlative is repeatedly placed parallel to a positive in such a way that the difference is effaced: II, 8, 19: *si sit optima seu vitiosa,* VIII, 1, 7: *quæ gravissimæ duræque et insuaves sunt partes.* (Of course there are cases where no harm is done by such a juxtaposition, and where it may occur even in classical authors; see Wölfflin, *Lateinische und romanische Comparation,* p. 54 f.; but this is not the case here.)

Among the adverbs may be mentioned *aliter,* not in the sense of "otherwise," but "differently one from another:" II, 1, 1: "in eo hominum congressu profundebantur aliter e spiritu voces," cf. IX, 4, 1; *forte=fortasse* VI præf. 4: "Sed forte non nulli hæc levia putantes eos putant esse sapientes, qui pecunia sunt copiosi"; *parve* IX, 6, (4) 5: "parve per eos flectitur delphinus"; *temperate* (with genitive as *parum*) I, 4, 7: "volucres minus habent terreni, minus umoris, caloris temperate, aëris multum," cf. II, 7, 3, II, 9, 9 & 11.

iuxta = secundum "according to:" I, 1, 17, "iuxta necessitatem." The same occurs in Justinus and later. *trans* without an object, "on the other side," IX, 4 (1), 4: "circumacta trans locis patentibus ex obscuris egreditur ad lucem," elsewhere in clerical authors, comp. *Archiv für lateinische Lexikographie und Grammatik* IV, p. 248. *trans contra* "opposite to," IX, 4 (1), 2 & (2), 2 as in Aurelius Victor and Boethius, comp. *Archiv f. lat. Lex.* V, p. 319 ff.

In the use of prepositions we are struck by several peculiarities which indicate the dissolution of the language: *ab,* indicating the cause, "because of," in II, 9, 11: "ab pondere umoris non habent rigorem . . . ab lentitudine firmas recipiunt catenationes," II, 9, 14: "ab suci vehementi amaritate ab carie aut tinea non nocetur." *ab,* "compared with," has been—no doubt correctly—substituted by Rose for *ad* in VI, 4, 5: "non enim atria minora ab maioribus easdem possunt habere symmetriarum rationes," a habit which Wölfflin in *Archiv f. lat. Lex.* VII, S. 125 has proved to exist in the ancient Latin translations of the Bible, Itala and Vulgata, and which is analogous to the use of other preposition such as *præ, super* or *supra, ultra.*

ad is placed instead of the dative or parallel with it, as in IV, 3, 2: "metopæ quæ proximæ ad angulares triglyphos fiunt," VII, 13, 2: "hæ regiones sunt proximæ ad septentrionem" (equally by Euodius in Augustine *Ep.* 158, 2: "ad finem vitæ proximus"), VI, 9, (6), 2: "lavationi rusticæ ministratio non erit longe," but soon after: "ad olearios fructus commoda erit ministratio." Equally in X, 9 (4), 2: "ita hortis ad irrigandum vel ad salinas ad temperandum præbetur aquæ multitudo." X, 6, 14: "ut ad solvendum non

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esset" in lieu of the generally applied "solvendo." "On the whole," Praun observes on p. 65, "the preposition *ad* with the gerund or the gerundive has extended its sphere at the expense of the other constructions, the genitive, the dative, and *in* with the ablative."

de instead of the simple ablative in I præf. 2 : "parenti tuo de eo fueram notus." Likewise *e* in I, 1, 4 : "circini usum, e quo maxime facilius ædificiorum expediuntur descriptiones." About *ex* in expressions of measure, see below.

With regard to conjunctions, Dräger, *Histor. Syntax* II p. 153, has already pointed out that *aut* and *sive* are used quite indiscriminately by Vitruvius. A critic in the *Athenæum*, Jan. 1, 1898, says : "the misuse of *aut* and *sive* is no great matter." I had not expected this declaration from "a skilled reader." Most Latin scholars would have the contrary view.

Equally unclassical is the use of the negatives in sentences consisting of two alternatives. The word *neve* does not occur in Vitruvius. He always puts *ne* . . . *neque* instead of *ne* . . . *neve*, as I, 1, 7 : "ne sit cupidus neque in muneribus capiendis habeat animum occupatum." As for negations, it is also to be observed that he likes to place them foremost in the sentence. He says "non putavi prætermittendum" instead of "putavi non prætermittendum," "non puto dubium esse," &c. This is done occasionally in other authors, but in Vitruvius very frequently. A striking example is II, 8, 8 : "non enim quæ sunt e molli cæmento, non eæ possunt esse in vetustate non ruinosæ."

It is a well-known fact that in the silver age the conjunction *num* is gradually replaced by *an*, and later on disappears entirely from the language. In Vitruvius *num* does not exist at all, neither do we find (the single) *an*, *ne*, nor *nonne*. The only particle by which he introduces a dependent interrogative clause is *si*, e.g. II, 8, 19 : "si est firma probatur," cf. II præf. 3, VI præf. 6, VII præf. 5, VII extr. al. Only in double clauses we find *utrum* . . . *an*, as I, 4, 9 : "dubitantes utrum morbo an pabuli vitio læsa essent." But *si* occurs equally, comp. II, 8, 19 : "de ipsa autem testa, si sit optima seu vitiosa, statim nemo potest iudicare." VII, 5, 4 : "neque animadverterunt si quid eorum fieri potest necne." *Si* in this sense already occurs in Plautus ; so we do not wonder that it is found in Vitruvius, but we wonder that it is the only interrogative conjunction he knows, as it is the only one which has migrated into the Romance languages. Whether this *si* is due originally to an influence from the Greek language, I dare not decide. The most ancient Roman authors not unfrequently borrowed words from Greek to express ideas or to name objects for which their own language lacked words, but they did not borrow forms or constructions. The age of Cicero and Augustus tried to remove the Greek words and to keep the language pure, but these attempts did not entirely succeed, and in the silver age we find repeatedly that where it became necessary to use Greek words, the authors liked to show their knowledge in retaining the Greek flexions, as *os* in the nominative instead of *us*, *u* in the genitive, &c. In the course of time such hellenisms increased, and the great number of them which occur in Vitruvius also help to indicate the period when he lived. He uses Greek words not only where he may possibly quote from a Greek source, but also in his own argumentations, and connected with Greek flexions, as VI præf. 4 "philologis et philotechnis rebus," X, 4, 5 "colossicotera," I, 1, 13 "aniatrologetos." He does not even seem afraid of *ois* instead of *is*, as "pentadorois" II, 3, 3.

A characteristic hellenism is the use of the genitive corresponding to the comparative *than*, as V, 1, 3 : "superiora inferiorum fieri contractiora," I, 5, 4 : "ut ne longius sit alia ab alia sagittæ missionis" (as in the manuscripts). This grecism is found in Apuleius, as in *Met.* III, 11 : "statuas et imagines dignioribus meique maioribus reservare suadeo ;" *de dogm. Plat.* I, 9 : "Animam . . . . omnium gignentium esse seniorem ;" in Tertullian, *Apol.* 40: "maiorem Asiæ et Africæ terram;" in the Latin translations of Irenæus and Hermes Pastor; very frequently in the oldest Latin translation of the Bible (Itala), as I Maccab. 6, 27: "maiora horum facient." The Vulgate here has the regular construction: "maiora quam hæc," and mostly so, but occasionally the genitive has been retained, comp. Wölfflin, *Archiv f. Lex.* VII, p. 117 ff. The above-mentioned reviewer in the *Athenæum* says that this "slipshod Greek genitive is not avoided by Plautus and Ennius." I should have been obliged to him for indicating the places. I thought I knew my Plautus pretty well, but I have never found it.

It has often been said that Vitruvius "translated largely from the Greek." I am not sure that he has translated more than the chapters of Athenæus which will be mentioned below. He seems more likely to have drawn his knowledge from Latin sources, but his style is appreciably influenced by Greek. Among these influences we will mention his preference for *non minus* (οὐδὲν ἧσσον) instead of *item*, comp. V præf. 3, VIII, 1, 5, IX, 3, 17, &c. Further the superfluous *etiam* (καί) in comparisons, as IX, 3, 11: "æquo pondere quo etiam fuerat corona." Equally the striking omission of the demonstrative pronoun before the relative, as I, 7, 1: "ædibus sacris quorum deorum maxime in tutela civitas videtur esse" and "Herculi in quibus civitatibus non sunt gymnasia," and the still more striking attraction of the relative II, 1, 4: "spatio relicto quanto arborum longitudines patiuntur."

In the syntax of Vitruvius, one of the things that attract our attention is his way of expressing measures. He often uses the regular construction with the accusative, as IV, 4, 1 "latitudine maior quam pedes XX;" but he equally employs the genitive, a construction which also appears in more ancient authors, as Varro and Pliny, *H. N.* XXXVI, 92 f.: "(pyramides) imæ latæ pedum quinum septuagenum, altæ centenum quinquagenum" &c. Columel. II, 10, 16: "areas latas pedum denum, longas pedum quinquagenum facito." Plin. XVIII, 140, XXXVI, 7. Thus Vitruvius III, 4 (5), 1: "uti lata et longa sit columnæ crassitudinis unius et dimidiæ," cf. III, 4 (5), 3, IV, 7 (8), 1, IV, 4, 1, VIII, 6 (5), 1, VIII, 7 (6), 4 &c. But instead of this *genitivus qualitatis* Vitruvius also uses the ablative, comp. II, 3, 3: "longum sesquipede, latum pede," IV, 4, 2: "crassitudines (columnarum) extenuentur his rationibus, uti, si octava parte erunt quæ sunt in fronte, hæ fiant X parte."

A similar wavering is found in the local determinations. Country names are put in the ablative without preposition, as II, 6, 5 "Achaia Asia," VI, 1, 1 "Ægypto Hispania Ponto," VII, 13, 2 "Ponto et Gallia," VII, 7 frequently. Even the genitive appears, II, 9, 13: "Cretæ et Africæ." Names of towns in the ablative instead of the genitive, II, 8, 9: "Arretio," IV, 7 (8), 4 "Sunio," VIII, 3, 8 "Zacyntho." This harmonises with the use of *eo* instead of *ibi*, V, 8 (7), 2: "eo tragici et comici actores in scena peragunt," X, 22, 12: 16 "arboribus excisis eoque collocatis." (If the same is found in Cicero's *Ep. ad Brutum* I, 2, 1, it may as well be considered as a testimony against the genuineness of those epistles.)

Noceri is constructed personally in the passive voice, II, 7, 3: "neque ab ignis vehementia nocentur." II, 9, 14: "larix ab carie aut tinea non nocetur." Similarly Apuleius *de dogmate Platonis* II, 17.

Est causa cognoscere, II, 9, 15, instead of *cognoscendi*, is a construction now and then occurring in the poets, comp. Madvig, *Lat. Gr.* § 419. It has been noticed that the genitive of the gerund is very rare in Vitruvius, whereas the ablative is exceedingly frequent, comp. Praun, p. 57 ff. It is, as we know, the ablative form which passes into the Romance languages Italian and Spanish.

As to moods, it is a fact sufficiently well known that the general rule followed by all classical prose writers, to express a dependent interrogative clause by the subjunctive, holds good no longer when the language approaches daily talk, especially in Terence and Plautus, comp. Madvig, *Lat. Gr.* § 356 Obs. 3. Attempts have been made, especially by E. Becker in Studemund's *Studia ad priscos Scriptores Latinos* I p. 117 ff., to draw distinct limits between the application of the subjunctive and the indicative in Plautus, but without any real result. In Plautus we find the indicative also in several of such sentences which according to Becker's opinion ought to have the subjunctive; we even see both moods indiscriminately in the same sentence, comp. my comment on Plautus' *Amphitruo* v. 17. It is the negligence of every-day talk which has been used by the author where it suited him for his rhythms; but no classical prose writer would indulge in putting the indicative in a dependent clause which really expresses a reflection or a doubt. Nevertheless Vitruvius has in II, 6, 4: "Relinquetur desideratio . . . ., quid ita non etiam ibi nascitur pulvis," II, 9, 17: "Insequitur animadversio, quid ita quæ in urbe supernas dicitur abies deterior est, quæ infernas egregios in ædificiis ad diuturnitatem præstat usus," X, 22 (16), 10: "ex eo intellectum est, qua ratione adversarii . . . . penetrare cogitabant." Praun quotes some more passages on p. 72. The disregard of rules appears most clearly where the indicative and the subjunctive are placed side by side in the same sentence, II, 9, 17: "De singulis generibus quibus proprietatibus e natura rerum videantur esse comparatæ quibusque procreantur rationibus, exposui," cf. II, 10, 3, VI, 11 (8), 8: "quibus rationibus hæc poterunt esse firma et quem ad modum instituantur, exposui." IX, 8 (7), 7: "quæ nobis tradita sunt et a quibus sint inventa, dicam."

That we frequently find the indicative in relative clauses of an oratio obliqua where the subjunctive ought to be used, and *vice versâ*, the subjunctive substituted for the indicative, is a fact which we will not stop to consider, as similar irregularities may also appear in other authors, comp. Madvig, *Lat. Gr.* § 369 Obs. 2 and 4. But it is certainly unclassical to employ the subjunctive in an indefinite relative clause, as VII præf. 9: "Quorum utrum ei acciderit, merenti digna constitit pœna."

Finally we shall briefly mention the position of the words. We have already noticed the inclination to put the negation foremost in the sentence. Similarly the auxiliaries, *esse*, *posse*, and *velle*, &c. are preferably placed before the infinitive to which they belong, as 1, 1, 16: "ut possint . . . disciplinas penitus habere notas." IV, 3, 2: "qui metopas æquales volunt facere." In sum, the governing verb is very often put before its object, whether a word or a whole sentence.

These features and many others point to the decadence of the Latin language and to its transition to the Romance tongues. We have indicated that this phenomenon has been differently explained by many philologists. They attribute it to the influence of the vulgar tongue, for it is thought that even at the remotest ages there existed besides the literary language a popular tongue which differed very much from it, and was the real source of the Romance languages. To be sure, we find in all nations a difference between the way of speaking of educated people and that of the lower classes. The language appears somewhat more refined in the former and somewhat negligent in the latter; in the former it is enriched by some notions of a superior culture of mind, in the latter by some old words forgotten by cultivated society, and by some more or less arbitrary formations (slang properly speaking does not belong to the language, and a writer like Vitruvius would be the last to make usé of it). However, in spite of this difference, it remains the same language. It has not been proved yet that it was not so with the Romans, or that there existed, even in the classical ages, a popular tongue similar to that which we find towards the close of the empire. In quoting Vitruvius as a witness it has been overlooked that he himself—as we have seen—boasts of his culture, and that his style is very far from being that of a plain uneducated man. It has equally escaped notice that, as we are going to show, not only in the language but in the subjects treated, there is much which could not possibly have been written at the time of Augustus.

II

If the language is striking, the style is no less so. It is, as we see from the above-quoted specimens, highly affected. The author imitates the classics, but his imitation turns out unsuccessful. This is shown at once in the dedication :

> Cum divina tua mens et numen, imperator Cæsar, imperio potiretur orbis terrarum invictaque virtute cunctis hostibus stratis, triumpho victoriaque tua cives gloriarentur et gentes omnes subactæ tuum spectarent numen populusque Romanus et senatus liberatus timore amplissimis tuis cogitationibus consiliisque gubernaretur, non audebam, tantis occupationibus, de architectura scripta et magnis cogitationibus explicata edere, metuens ne non apto tempore interpellans subirem tui animi offensionem. Cum vero attenderem te non solum de vita communi omnium curam publicæque rei constitutione habere, sed etiam de opportunitate publicorum ædificiorum, ut civitas per te non solum provinciis esset aucta, verum etiam ut maiestas imperii publicorum ædificiorum egregias haberet auctoritates, non putavi prætermittendum quin primo quoque tempore de his rebus ea tibi ederem, ideo quod primum parenti tuo de eo fueram notus et eius virtutis studiosus. Cum autem concilium cælestium in sedibus inmortalitatis eum dedicavisset et imperium parentis in tuam potestatem transtulisset, idem studium meum in eius memoria permanens in te contulit favorem. Itaque cum M. Aurelio et P. Minidio et Cn. Cornelio ad apparationem ballistarum et scorpionum reliquorumque tormentorum refectionem fui præsto et cum eis commoda accepi ; quæ cum primo mihi tribuisti, recognitionem per sororis commendationem servasti. Cum ergo eo beneficio essem obligatus, ut ad exitum vitæ non haberem inopiæ timorem, hæc tibi scribere cœpi, quod animadverti multa te ædificavisse et nunc ædificare, reliquo quoque tempore et publicorum et privatorum ædificiorum pro amplitudine rerum gestarum ut posteris memoriæ tradantur, curam habiturum. Conscripsi præscriptiones terminatas, ut eas attendens et ante facta et futura qualia sint opera per te posses nota habere ; namque his voluminibus aperui omnes disciplinæ rationes.[1]

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[1] "When thy divine mind and genius, Emperor Cæsar, was extending its dominion over the whole world, and when all enemies had been defeated by thy invincible valour, and thy compatriots glorified in thy triumph and victory, and all peoples looked up humbly to thy divinity, when the Roman people and senate, relieved from fear, were ruled by thy sublime thoughts and counsel, I did not venture, in the midst of such grave business, to come forward with my work about architecture, which I had executed with great efforts of thought, for fear of interrupting thee at an inconvenient time and incurring thy displeasure. But observing that thou didst not only take care of the common welfare of all and of the constitution of the state, but also of the convenient arrangement of public buildings, so that by thee not only provinces might be added to the state, but also the sublime empire might have excellent models of public buildings, I thought I ought not to forbear presenting thee as soon as possible with my book about these things. For thy father knew this quality of mine, and I had taken an interest in his "virtue" (valour); but as, by the counsel of the gods, he has been transferred to the dwellings of immortality, and his dominion has been surrendered to thy power, this ardour of mine in clinging to his memory has transferred its favour to thee. Therefore, together with M. Aurelius, M. Minidius and Cn. Cornelius, I helped in the construction of ballistas and scorpions, and in repairing other shooting machines, and I received a salary as well as the others, an acknowledgment which thou grantedst me on thy sister's recommendation. So, being under an obligation to thee on account of this benefit, owing to which I need not be in fear of want as long as I live, I began to write this work for thee, because I had noticed that thou hadst built and wast still building much, as thou wishedst to take care of public as well as of private buildings, so that they might be left to the memory of posterity in a state harmonising with thy great deeds. I have put down definite rules, so that in observing them, without consulting others, thou mayst be able to know the ancient buildings as well as those that are to be erected, for in this book I have presented all the rules of the art."

The translation is made to be as correct as possible. Of course, a bad and affected Latin cannot

The author's model is the well-known letter from Horace to Augustus, which begins with the following lines:

> "Cum tot sustineas et tanta negotia solus,
> Res Italas armis tuteris, moribus ornes,
> Legibus emendes, in publica commoda peccem,
> Si longo sermone morer tua tempora, Cæsar."[1]

What a difference between these two dedications! We can scarcely imagine anything more refined and tasteful than the lines of Horace, and anything more coarse and out of taste than those of Vitruvius. We are surprised, to begin with, at the idea that a writer could think of imitating a contemporary author; but let us go a little into details. It is true, he commences by speaking of the divine spirit of Augustus, but a little later we read about his own great efforts of thought. We hear that he has known Cæsar and taken an interest in his "virtue," and that after Cæsar's death he has transferred his favour to Augustus. This emperor having, on the recommendation of his sister, given him a pension, he wishes to show his gratitude, and being aware that Augustus is fond of building, he has written this work that the emperor may get the information he wants about this subject. We see the author has no modest ideas of his own importance. A French author (Terquem, *La science romaine à l'époque d'Auguste*) excuses this arrogance by suggesting that Augustus might have asked Vitruvius to write his book; but the latter declares as distinctly as possible that he does it of his own accord, and in acknowledgment of received benefits.

Even the address *Imperator Cæsar* is startling. In the year 27 B.C. the senate conferred upon Octavianus the surname of Augustus; it was adopted by him, and from that moment it became permanent, and at any rate could not be replaced by *Imperator*, which indicated an inferior rank. But writers of the history of literature suppose that the book was written several years later. The author mentions the temple of Quirinus (III, 1 (2), 7), which was built in the year 16 B.C., and he knows only one stone theatre in Rome (III, 2 (3), 2), whereas the theatre of Balbus was constructed in the year 13. Therefore they conclude that the book must have been written in 14 B.C., and the letter of Horace which served as model for the author's dedication seems to have been written about the same time. Yet Augustus is not mentioned by the title of honour conferred upon him. That Horace, his intimate friend, calls him by his family name, is quite suitable, but an inferior like Vitruvius could not have avoided calling him Augustus. This omission on his side is so much the more surprising as he shows elsewhere that he knows the title quite well. In book V, chapter 1, he describes a basilica he has built in Fanum on the Adriatic, or Colonia Julia Fanestris, as he calls it, like Pomponius Mela. This building was connected with a temple for Augustus, *ædes Augusti*, which occupied the centre of the long side of the basilica, viewing the Forum and the temple of Jupiter. So there can be no doubt that he knew the name; still he always addresses his patron by the only title of *Imperator*, comp. the prefaces to Books II, III, IV, V, X.

In his dedication Vitruvius says about himself that he has done service in helping

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be translated into good and refined English without a complete alteration; it would be a paraphrase, not a translation. The very first sentence is badly expressed. Where Horace, his model, uses the present tense, Vitruvius has the imperfect; instead of saying: "As thou hast extended," he says: "When thou wast extending," which in this place has scarcely any sense.

[1] "While you alone sustain the important weight
Of Rome's affairs, so serious and so great:
While you the public weal with arms defend,
Adorn with morals and with laws amend,
Shall not the tedious letter prove a crime
That steals one moment of our Cæsar's time?"
(*Old English translation.*)

to construct machines of siege, and that he received a salary for this work; but why does he not tell us what we learn from Frontinus (see below), that he was an hydraulic engineer? It has been said that he may have got this office after having written his book. However, it seems very unlikely that a non-commissioned officer who had served his time and was pensioned should have been entrusted with such a post; that he did not know this art will be seen clearly below.

And in looking closely at the things he relates from Cæsar's time it becomes clear that he was not what he pretends to have been, an engineer in Cæsar's service. What he tells in book VIII, 4, 25 has been quoted in support of his assertion. He mentions a certain C. Julius, son of Masinissa, a great landed proprietor, who, we are told, went with Cæsar in his wars, and on these expeditions stayed with Vitruvius as his guest, and carried on learned conversations with him all day long. However, history knows nothing of such a Masinissa, for it is a quite arbitrary conjecture to identify him with the Masintha mentioned in Suetonius, *Jul.* 71, or with the Masinissa spoken of in Appianus, *Civil.* IV, 54, who was an eager Pompeian, and an ally of king Juba. Most likely this man never existed at all; anyhow, this story cannot be alleged as an argument for the trustworthiness of Vitruvius. But what shall we say to the following story?

II, 9, 15 &c. Cæsar, it is said, stood with his army near the Alps (*circa Alpes*). He had ordered all towns in the surrounding country to send him provisions, but there was a mountain fort which would not obey. This place had to be taken, and Cæsar advanced towards it. But in front of its gate stood a high tower built up of trunks placed alternately lengthwise and crosswise as a pile. Fire was laid to it, but it would not catch, and the town could only be made to surrender by a regular siege. Then Cæsar learned that these trunks which would not burn were those of the hitherto unknown larch-tree, *larix*, and that, therefore, the name of the castle was castellum Larignum: Larchtree castle. It strikes us as very peculiar that a small barbaric Alpine fortress bears a quite Latin name, and the whole tale about this incombustible tree is so evidently a cock-and-bull story, that we cannot possibly imagine it to have been written by an engineer in Cæsar's army. But the author betrays himself even more unmistakably by the story which he relates at the close of his work (X, 22, 11 ff.) about the siege of Massilia. The besiegers, he says, had dug more than thirty mines, and were counter-worked by the besieged, who deepened the moat in front of the wall and arranged water-basins in the town in order to let floods of water down upon those who advanced through the mines, thus finally gaining the victory. Now the history of Massilia does not allow us to think of any other siege than that by Cæsar in the year 49; for this state always stood in the most friendly relations to Rome and knew of no other enemies than the Gauls, by whom no siege is reported to have taken place, and to whom we cannot attribute such a methodical proceeding. But now we possess in the second book of Cæsar's *Bellum Civile* his own description of the siege. It gives a detailed report about the walls that were built, the towers and besieging machines which were conducted towards the walls; it tells us that the inhabitants set fire to these machines, that they were replaced by others, finally that the town had to surrender, for the besieged citizens did not gain the victory in the end. There is not a single word about mines; the whole tale about them is a fiction, and here we are fortunate enough to seize the impostor in the very act.

The only edifice of which our author speaks more in detail is the above-mentioned basilica which he says he has built in Fanum on the Adriatic. If we add to this his remark that in Ravenna all public and private buildings are based on piles, and that the larch-tree was used for this purpose, a tree which, he says, was only known in the towns on the mouths of the Po and on the Adriatic Sea, it seems natural to conclude that this was his home-country. To be sure, he was no Roman, for he knows very little about Rome; he only mentions incidentally that a private citizen on the Mount Aventine has used a colour which was not sufficiently durable. But it is most astonishing indeed that an architect who lived at a time when Rome was distinguishing itself by constructing the most splendid works of architecture, when Augustus was transforming "the town of bricks into a town of marble," when Strabo wrote his enthusiastic description of the world's capital (V, 3, 8), should remain quite unimpressed by these marvels. And we do not find the slightest indication of his being influenced by them, except in the above-quoted preface where he speaks of having noticed that Augustus has built and is building much, for which reason he wishes to give him useful advice.

Indeed, some of the magnificent edifices of Augustus were not finished in the year 14, the time when Vitruvius is supposed to have written his book. The Theatre of Marcellus was inaugurated three or four years later, and Forum Augusti with the temple of Mars Ultor only in the year 2 B.C.; but a large number were finished, as the temple of Cæsar, the temple of Jupiter Tonans, &c. &c., not to speak of the magnificent buildings of Agrippa on Campus Martius, the last remains of which—the Pantheon—we still admire, for though it may be only a shadow of what it was, restored by Hadrian and by Septimius Severus, and ill-treated in modern times, the preserved inscription: *M. Agrippa III cos. fecit*, bears witness that the ensemble is unchanged. Not a word about all this in Vitruvius. What he mentions of Roman buildings are mere trifles compared with those alluded to, and they all seem to *belong to an older time*. An exception might seem to be made by the temple of Quirinus, which in Vitruvius III, 1 (2), 7, is qualified as Doric and as dipteros octastylos, according to which it had probably 76 columns, as Dio Cassius LIV, 19, says of the temple inaugurated by Augustus in the year 16; but this was only a restoration, and the older temple which it replaced might quite well (in spite of Becker's arguments, *Röm. Topographie*, p. 572) have had the same size and the same number of columns, whereas we may justly ask why Augustus, if he wanted to construct a new and splendid edifice, did not here, as was his custom, use the Corinthian style instead of the Doric, which was little appreciated at his time.

Let us see which Roman buildings are mentioned by Vitruvius. In book III, 1 (2), 2, he speaks of a small, no doubt old temple of Fortune as an example of *ædis in antis*: "exemplar erit ad tres Fortunas ex tribus quæ est proxime portam Collinam." Immediately after he mentions as prostylos the temple of Jupiter and Faunus on the island, which according to Livy XXXIV, 53, was inaugurated in the year 194: "huius exemplar est in insula Tiberina in æde Iovis et Fauni." In § 5 he explains peripteros and then adds: "quemadmodum est in porticu Metelli Iovis Statoris Hermodori (codd. Hermodi) et ædis Mariana (codd. admariana) Honoris et Virtutis sine postico a Mucio facta." Here we must call special attention to the fact that Porticus Metelli no longer bore that name at the time when Vitruvius is supposed to have written his work; it was called porticus Octavia, as, after the Dalmatian campaign in the year 33, Octavian rebuilt it magnificently and gave it the name of his sister, Dio Cass. XLIX, 43. About the temple of Mucius we do not know anything at all. Finally Vitruvius III, 2 (3), 5, speaks of Tuscan temples: "uti est ad Circum maximum Cereris et Herculis Pompeiani, item Capitolii." The temple of Ceres was one of the oldest in Rome; the dictator Postumius in the battle of the lake Regillus B.C. 496 had vowed to build it; Dio Cass. L, 10 informs us that it was burnt B.C. 31, and in Tacitus, *Ann.* II, 49, we read that Tiberius inaugurated it A.D. 17 when it was rebuilt after having been destroyed by fire. Whether this be the fire mentioned in Dio, or another of later date, does not much matter to us; but suppose that Augustus had restored the temple immediately after the fire B.C. 31, it does not appear very probable that in the reconstruction he should have maintained the Tuscan style with its inflammable timber-work and roof. They did not proceed in that way with the Capitolium; Dionysius Halic. IV, 61 says that it was reconstructed on the same plan as before, but of more expensive material, which agrees well with the report that Sulla is said to have used pillars which were meant for the Olympieum in Athens, accordingly Corinthian.

Other temples too are occasionally mentioned by Vitruvius, as those of Salus, Flora, Fontus, Fortuna equestris, that of Luna to which Mummius gave the copper vessels which he was said to have taken from the theatre in Corinth, where they had served to increase the power of the singers' voices by their resonance; the temple of Castor on the Circus Flaminius, that of Vejovis on the Capitol, and that of Diana near Aricia. All of these are older temples and belong to the time of the republic. The latest ones which he mentions are the temple of Venus on the Forum of Cæsar, and the temple built in honour of Cæsar immediately after his death, Ædes Divi Iulii, on the Forum Romanum. The latest secular building he speaks of is the theatre of Pompey. What the basilica Iulia Aquiliana (V, 1, 5) means we do not know.

Undoubtedly all these examples are not drawn from his own memory, but borrowed from the same book which has supplied him with the system of the development of temple-building which was meant to be illustrated by these examples. Now, what book was this? Vitruvius himself mentions his predecessors, VII præf. 14: "Fuficius nimirum de his rebus primus instituit edere volumen, item Terentius Varro de novem disciplinis unum de architectura, P. Septimius duo; amplius vero in id genus scripturæ adhuc nemo incubuisse videtur, cum fuissent et antiqui cives magni architecti, qui potuissent non minus eleganter scripta comparare." Of the first and the last of the authors mentioned here, Fuficius and Septimius, we know nothing; whether Vitruvius knew them may also be questioned; but VARRO's work, *De novem disciplinis*, one book of which treated about architecture, was certainly read throughout centuries till it was superseded by Martianus Capella. No doubt it is this book which was used by Vitruvius. The systematism found here is quite in Varro's taste. Though he may not have originated it himself, but taken it from Greek predecessors, we understand easily that he chose his examples from republican Rome. Varro died at the old age of 99, A.D. 28 or 29. An author who lived at the time of Augustus would undoubtedly have chosen his examples among the splendid buildings known and admired by everybody, and not from the Rome which was vanishing and for which nobody cared much, nor would monuments which had changed names have been mentioned by their old long-forgotten names.

That Vitruvius was no real architect, only a man who took an interest in architecture and kindred branches, who had read something about these matters, and now fancied himself to be a wise man and to be able to teach others, will not escape the attention of critical readers. How could a real architect in writing a manual about his profession have overlooked the difference between burnt and unburnt bricks? Or has he forgotten to mention the burnt brick, the only material used in his time? How could he have forgotten to include such important matters as the construction of arches and vaults? It does not improve the case that he tells us a great deal about music, clocks, machines of war, the names of the winds, curiosities of geography and natural history, as well as unreliable historical anecdotes. How could a man who had actually built a colonnade let the unit of measure, the *modulus*, by which all the measures of the building were determined, in one place be the diameter, in another the radius of the column? Of the former we find an instance in III, 2 (3), 7; of the latter in IV, 3, 3. How could a real hydraulic architect have committed the blunder of giving an aqueduct a slope of ½ ft. to a length of 100 ft. instead of $\frac{1}{48}$? For in Vitruvius VIII, 7 (6), 1 we read "ne minus in centenos pedes semipede," and not, as the latest editors have corrected it after Pliny XXXI, 57, "sicilico." That such a correction is unjustifiable from a critical point of view goes without saying; but it is interesting enough to see that Cetius Faventinus, the epitomist of Vitruvius, had already discovered his mistake and put something quite different in the place of it: "if the duct is horizontal, it must at intervals of sixty or a hundred feet have a gentle slope of about 1½ ft.[1] in length"; of the angle of the inclination he says nothing.

Whether the basilica in Fanum was actually built by our Vitruvius, we cannot tell; it is no tasteful work of art and does not resemble the monumental buildings of the Augustan age. Also the architectural rules which he gives in his ten books are not put down as derived from his own experience, but as those "he had received from his teachers" (IV, 3, 3: "exponimus quemadmodum a præceptoribus accepimus"). They harmonise so well with Pliny XXXVI, 178 f. that most likely they are drawn from the same source, and here it seems most natural to think of Varro. When, for instance, Vitruvius, like Pliny, determines the height of the Doric column to six times the lowest diameter, this proportion agrees with the market-gate in Athens (A.D. 2), whereas in the colonnades in Pompeii and other later monuments we find the proportion to be 7 : 1 or more. Among the rules of Vitruvius there are others which please us less, as where he says—IV, 1, 2—that in the Corinthian order the entablature may be not only Ionic but also Doric, or where—IV, 3—in order to prevent disturbing the division of the triglyphs, he recommends placing half a metope at the corners of the colonnade, a tasteless arrangement which hitherto has been found only in the Thermæ of Diocletian and in the small temple in Pæstum, the roof of which belongs to a later restoration. Whether these rules were found in Varro, we do not know, but it is quite sure that no architect of the Augustan age would have acknowledged them.

It has been said that Vitruvius worked from excellent Greek sources. Of course he knew some Greek; it will be seen below how he translated the Greek mechanician Athenæus; but his knowledge of Greek literature was scarcely great. He gives himself airs by quoting a number of authors whom he pretends to have used, several of whom are quite unknown, and even if they did really live, they can scarcely have been accessible to a Roman of the time of Augustus, much less to an uncultivated practitioner, as he is said to have been. The way in which he displays his knowledge, at once makes us feel as if it were not genuine, and this suspicion increases in meeting a similar list of sculptors and painters in the preface of book III, § 2, in which he wishes to prove the remarkable assertion that the unknown artists were as clever as the most celebrated. Let us look a little more closely into these passages. In VIII, 4 (3), 27 he says that his knowledge of the water-courses in the earth is due partly to his own experience, partly to the Greek authors Theophrastus, Timæus, Posidonius, Hegesias, Herodotus, Aristides and Metrodorus. In Herodotus, as we know, nothing is found concerning this matter; Theophrastus may have mentioned it; and it is possible that Timæus, Posidonius and Hegesias may here and there have contained allusions to it; but it is quite improbable that such matters should have been found in Metrodorus, a disciple of Epicurus, and what shall we say about Aristides, the rhetorician of the second century of the Christian era? Either the author did not know when he lived, or he has forgotten himself. Any way, he is found out. It will be objected that he does not mean these authors but others unknown to us. But here they are quoted as highly considered authorities along with the most famous writers. In the preface of book VI, § 3 Vitruvius cites the following words of Epicurus: that the wise man owes but little to luck; the greater and essential part of his success depends on his own soul. He adds that other philosophers have said the same, "and also ancient Greek dramatic authors such as Eucrates, Chionides, Aristophanes, and above all Alexis." Now there is none of the name of Eucrates; it might perhaps be corrected to Crates; but we may be quite sure that Vitruvius had never read a line either of Crates or Chionides; of Aristophanes and Alexis only he may have seen quotations in later authors. In his preface to book VII, § 11 ff. he states that Agatharchus, who painted theatrical decorations for Æschylus, had left a commentary on his works, after which Democritus and Anaxagoras had given a detailed development of the theories of perspective. He continues:

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[1] Faventin. c. 6 (p. 298, Rose): Si longior planities fuerit, pede semis inter centenos vel sexagenos pedes structura submittatur, ut animata aqua non pigro impetu decurrat. After him Palladius IX, 11: Si per planum veniet, inter sexagenos vel centenos pedes sensim reclinatur structura in sesquipedem, ut vim possit habere currendi.

> Afterwards, Silenus published a book about the proportion of the Doric buildings (*de symmetriis Doricorum*); Theodorus one about the Doric temple of Juno in Samos; Chersiphron and Metagenes about the Ionic temple of Diana in Ephesus; Pytheus about the Ionic temple of Minerva in Priene; Ictinus and Carpion about the Doric temple of Minerva in the castle of Athens; the Phocion (*Phocæus*, it is probably meant to be *Phocensis*) Theodorus about the rotunda in Delphi; Philo about the correct proportions in temples and about the arsenal he built in Piræus; Hermogenes about the Ionic pseudo-dipteral temple of Diana in Magnesia and the monopteral temple of Dionysus in Teos; Argelius about the Corinthian proportions and about the Ionic temple of Asclepius in Tralles, which he is said to have built himself; Satyrus and Pytheus about the Mausoleum.

Several of these are not known from elsewhere: Silenus, Carpion, Argelius, Theodorus the Phocian, and the builders of the Mausoleum. In calling the temple of Juno in Samos Doric, he commits a mistake; even the most ancient recently discovered remains are Ionic (comp. Gérard, *Bulletin de Correspondance Hellénique*, IV, p. 389). In § 14 he continues:

> Furthermore there are many less famous authors who have put down rules of proportion, such as Nexaris, Theocydes, Demophilos, Pollis, Leonidas, Silanion, Melampus, Sarnacus, Euphranor.

Of these Silanion and Pollis are sculptors, Leonidas a painter, Euphranor a painter as well as a sculptor, but not an architect; the others are entirely unknown. That Euphranor and Silanion belong to the celebrated names in the history of fine arts, the author does not know. He continues:

> Others have written about machines, as Diades, Archytas, Archimedes, Ctesibius, Nymphodorus, Philo from Byzantium, Diphilos, Democles, Charias, Polyidos, Pyrros, Agesistratos. From their memoirs I have drawn what I considered would be of use and gathered it in one work ("quorum ex commentariis quæ utilia esse his rebus animadverti, collecta in unum coëgi corpus").

Here, too, we find several quite unknown names, whereas Athenæus, whom Vitruvius himself has plagiarised, is not mentioned; he probably lived so close to the author's own time that he would have betrayed himself in mentioning him. The real truth about this quotation will appear distinctly from X, 19 (13), 3, where he relates that at the siege of Byzantium Philip II of Macedonia used machines which had been constructed by the Thessalian Polyidos, whose disciples Diades and Charias served under Alexander. This is literally translated from Athenæus, as will be proved below. Vitruvius had never seen writings of Polyidos, Diades and Charias; he quotes their names from Athenæus. He only uses the source nearest at hand, and all his parading with the great names of the past is nothing but humbug, to which those that write history of literature should take good care not to refer.[1]

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[1] The same verdict is pronounced by Urlichs, *Ueber griechische Kunstschriftsteller* (1887) p. 17.

The accounts given by Vitruvius about Greek architecture are certainly not drawn from the ancient architects whom he mentions, of whom perhaps only a few were writers themselves. He has used a source which was closer to his own time, no doubt, as we have said, Varro. This, for one thing, appears from his description of the Greek theatre. It is in book V, chap. 6 and 7, that he treats of the theatres, first the Roman, then the Greek. His description of the Roman theatre agrees pretty well with the monuments; here he describes what he has seen with his own eyes. With regard to the Greek theatre it is different; the question is about a structure which he had not seen, and which was previous to his own time. However, the principal features are the same, so that the two descriptions may go parallel with each other. As the fundamental difference he points out: that in the Greek theatre the stage, which takes up the hindmost part of the orchestra, is formed by cutting off $\frac{3}{12}$ of the circle of the orchestra, in the Roman by cutting off $\frac{4}{12}$. "Thus," the author says, "the stage of the Roman theatre is broader than that of the Greek, because in Rome all artists perform on the stage, whereas the senators have their seats in the orchestra. The height of the stage must not exceed 5 ft., in order to allow the spectators in the orchestra to see all the movements of the actors"[1] (chap. 6, 2).

About the Greek theatre he says, chap. 8 (7), 2:

> It has a larger orchestra and the stage is further back and less deep. It is called logeon, because the tragic as well as the comic actors perform there, while the other artists display their art in the orchestra, for which reason they are distinguished from each other by the names of scenici and thymelici. The height of this logeon ought not to be less than 10 ft. and not to exceed 12 ft.[2]

So the Greek logeum corresponds exactly to the Roman pulpitum; but while the latter is five feet higher than the orchestra, the former is ten to twelve feet higher. We are astonished at this height, the reason of which we do not understand. It would absolutely prevent the spectators who were sitting in the front seats—the places of honour—from "seeing all the movements of the actors," as was said to be their right. Anybody who doubts whether this is the case may find it confirmed in Dörpfeld, *Das griechische Theater*, p. 356. Therefore nobody credited this statement with being correct until quite recently it seemed to be borne out monumentally at the excavation of the theatre in Epidaurus, in which appeared behind the orchestra a colonnade exactly eleven feet high. Though, according to the construction described by Vitruvius,[3] this was to be the hindmost limit of the stage, the *frons scenæ*, it was now supposed to be the foremost one, the *finitio proscenii*. The performers were not thought to have acted in front of these columns, but on the roof which covered them. The depth of this supposed stage, which Vitruvius has not indicated, is determined by the wall of the stage-building which rises about it. It would be three metres by a length of twenty-two, a form and size which would seem not only unsuitable, but simply impossible, especially if we consider that it had to be furnished with a railing in order to prevent the actors from falling down into the abyss in front. But it is not so. The above-mentioned colonnade is not meant as an ornament to the foundation of the stage, the hyposcenium, as Pollux calls it, and as it is known from the latest reconstruction of the theatre in Athens. Its right name is proscenium (προσκήνιον). This we know for certain from the small theatre near Oropos, where the corresponding colonnade has still preserved its inscription in which this name is given to it (comp. Dörpfeld, *Das griechische Theater*, p. 102). But the word *proscenium*, which from the beginning only meant the colonnade in front of the back wall (σκηνή), was afterwards taken in a wider sense and designated the whole space in front of this back wall, viz. the place on which the actors performed the play. In this sense the Romans took it up already from the time of Plautus, and in this sense it is used elsewhere by Vitruvius. Thus it was natural enough that he misunderstood Varro where the latter, according to Greek sources, stated the height of the proscenium to be ten to twelve feet, taking it to mean the same thing which he used to call by this name and then changing it with the word logeum, which in his opinion was synonymous with it. Of course such a misunderstanding is unjustifiable, but we understand that it could occur, especially in an author who lived towards the close of the Roman empire and never had seen the ancient Greek theatres.

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[1] Ita latius factum fuerit pulpitum quam Græcorum, quod omnes artifices in scena dant operam, in orchestra autem senatorum sunt sedibus loca designata; et eius pulpiti altitudo sit ne plus pedum V, uti qui in orchestra sederint, spectare possint omnium agentium gestus.

[2] Ampliorem habent orchestram Græci et scenam recessiorem minoreque latitudine pulpitum, quod λογεῖον appellant, ideo quod eo [codd. "eos," perhaps "apud eos"] tragici et comici actores in scena peragunt, reliqui autem artifices suas per orchestram præstant actiones, itaque ex eo scenici et thymelici Græce separatim nominantur. Eius logei altitudo non minus debet esse pedum X, non plus XII.

[3] V, 8 (7), 1: cuius quadrati latus est proximum scenæ præciditque curvaturam circinationis, ea regione designatur finitio proscenii, et ab ea regione ad extremam circinationem curvaturæ parallelos linea designatur in qua constituitur frons scenæ.

There are other passages which testify to the fact that the author did not live at the time of Augustus. In I, 7, 1 rules are given for the places in which the temples of the different gods were to be situated : " Those of Jupiter, Juno and Minerva were to stand in the highest place, but that of Mercury in the market place, or, like those of Isis and Serapis, near the harbour (" ut Isidi et Serapi in emporio "). This would be quite natural in the second century of our era and later on, when the worship of Isis was spread everywhere, and particularly was never missing in a town with a seaport; but at the time of Augustus it was different. It is true, the worship of Isis had penetrated to many places, but it had also met serious resistance in the Roman countries, and the senate had several times forbidden this foreign worship. These interdicts surely did not prevent temples to Isis being built here and there; nay, in 43 B.C., the year of dissolution, official assent was granted to the erection of a temple to Isis and Serapis (Dio Cass. XLVII, 15), no doubt a concession to the lowest class; we are not told where this temple was situated, but it was certainly outside the town, probably far out on the Campus Martius; very likely it was the Iseum Campense in which Vespasian spent the night before his triumphal entry into Rome; but this was a particular exception. In the year 21 Augustus prohibited Egyptian divine worship in the city of Rome and its nearest surroundings up to 7½ stadia (Dio Cass. LIV, 6), and for some time to come the disposition of the government did not relax. In A.D. 19 even a serious attempt was made to remove this foreign cult altogether from Italy. The worshippers of Isis were ordered to burn their costumes and implements; four thousand adorers of Isis and Jews were enlisted in a body of troops which was sent to Sardinia never to return, and the others were exiled from Italy (Suet. *Tib.* 36, Tac. *Ann.* II, 85). Now, can we imagine that an author who dedicates his work to Augustus can mention the worship of Isis and Serapis as taking place in all towns, and coordinate them with Jupiter, Juno and Minerva, Apollo, Liber Pater, Hercules, Mars and Venus, for these are the gods he mentions? There are other absurdities in the same place. " Hercules," it is said, " is to have his temple near the circus in the towns where there are no gymnasiums or amphitheatres " (" in quibus civitatibus non sunt gymnasia neque amphitheatra "). Elsewhere we never hear anything about gymnasiums in Roman cities; and as for amphitheatres, we know that at the time of Augustus Rome possessed only one, not very considerable, built of stone by Statilius Taurus. In Vitruvius it is supposed that amphitheatres were found in all tolerably large cities, which was indeed the case at the later time of the empire. He further gives the rule that the temple of Mars is to be situated outside the town; but Augustus built a temple to Mars Ultor, the splendid remains of which are still to be seen on his Forum in the middle of the city of Rome. Also the temple of Ceres should be erected outside the town, but the ancient well-known temple of Ceres Liber and Libera was situated in the city near the Circus Maximus.

In I, 2, 5 rules are laid down as to the orders to be chosen for the temple of each deity, but in reality the style of the building was never dictated by the character of the particular god, but by the artistic taste of the period to which it belonged. We are taught that Minerva, Mars and Hercules were to have Doric temples, but the recently mentioned temple of Mars Ultor, as we know, is Corinthian, and the round temple on the bank of the Tiber, generally called the temple of Vesta, though in reality it seems to have been dedicated to Hercules (comp. Becker's *Röm. Topographie*, p. 478), is also Corinthian.

In I, 6 Vitruvius speaks in detail about the winds, and not contenting himself with four, eight, or twelve, he mentions twenty-four different winds, for several of which he himself must find names. With this statement it is worth while comparing what Seneca says, *Quæst. nat.* V, 17 : "Placet duodecim ventos esse, non quia ubique tot sint, sed quoniam nusquam plures sunt." He counts twelve winds, not because there are so many everywhere, but because there are no more anywhere. He has never heard of more. If an author of some note at the time of Augustus had established twenty-four, he could not have ignored it.

In II, 6, 2 it is stated that in former times the heat increased under Mount Vesuvius and became so great that fire was vomited forth over the fields all round ("memorantur antiquitus crevisse ardores et abundavisse sub Vesuvio monte et inde evomuisse circa agros flammam"). Evidently he has heard of the great eruption A.D. 79. At the time of Augustus people did not speak of Vesuvius in that manner. Strabo says (V, 4, 8) that "the top of the mountain is waste and ashy, so that it may be concluded that this spot has formerly been burning but is now extinguished, as the combustible matter has been consumed." He has not heard of any eruption; he only draws the conclusion that there may once have been a subterraneous fire.

In I, 4, 9 we read : "Our ancestors sacrificed cattle which grazed in the places where towns or permanent camps were to be constructed. They examined the livers of the animals, and if they found them greenish and diseased the first time, they sacrificed others, as they could not know whether this was due to illness or to bad food. If after several attempts they had made sure that the livers were sound and had not been damaged by water or food, they built the fortresses there ; but if they discovered that the livers were diseased, they changed their resolution, thinking that the water and the food which were found in these places must also be dangerous to men, and they moved to other places." To Vitruvius the examination of the intestines of the victims is a custom used by the ancients (*maiores*), but it was practised at the time of Augustus. Would he who showed so much zeal for the preservation of the old religion have neglected an act the omission of which might have demoralised the army at the most decisive moment? And does not Lucan (I, 610 ff.) give us a detailed description of this act? Vitruvius has no idea of the real meaning of the examination of the liver. To him it is a means of finding out the quality of the water. And this test he applies not only where a suitable place for building a town is to be found, but also where a favourable spot for a camp has to be chosen, though in the latter case strategical considerations were of greater importance than the question about the wholesomeness of the water. It is evident that by *castra stativa* he means something different from what bore this name at the close of the republic; he thinks of a fortified town like those that were built in order to defend the boundaries of the empire.

IV, 5, 1 Vitruvius speaks of the orientation of the temples of deities, saying: "If no particular circumstances put obstacles in the way, the temple and the statue of the god which stands in it shall turn towards the west, so that those who go up to sacrifice at the altar may look towards the rising sun, and the divine statues may seem to stand looking at those who offer prayer and sacrifice." This is astonishing! We know that in Greece the temples of the gods faced the east, and only those of deceased heroes had their entry to the west. Etruscan temples turned towards the south. In the beginning the Romans followed the Etruscan system, but the temples of those gods which they had in common with the Greeks were oriented as in Greece, unless the soil and the environs necessitated another direction. This is just the contrary of what is taught by Vitruvius. We know that the oldest Christian churches were oriented like the Greek temples, but that during the fourth century the system was changed and the opposite direction was required, so that the churches had their entry on the western side. And it is this rule which Vitruvius applies to the heathen temples. Another reason why it seems that he cannot have lived before the fourth century.

We will mention one passage more which has been supposed to prove that the author lived at the close of the republic. In IX, 3, 17 he says that through the writings of an author we make his personal acquaintance. "Plures post nostram memoriam nascentes cum Lucretio videbuntur velut coram de rerum natura disputare, de arte vero rhetorica cum Cicerone, multi posterorum cum Varrone conferent sermonem de lingua Latina."[1] The writer speaks as if he were a contemporary of these authors, but at the age of Augustus Lucretius was little known as a poet, and nobody would have quoted him as a natural philosopher, nor in Varro was it the linguistic, but the historical and antiquarian knowledge that was admired. It is the scholastic learning of the later time that we meet in these examples taken from the three divisions of the school: grammar, rhetoric and dialectic.

III

All these indicia I think may have convinced the reader that the work in question was not written during the Augustan age; nevertheless, the champions of the common opinion pretend that they are all deceptive tokens, because Pliny and Frontinus have read and used the book. So we are obliged to show that this is not the case.

The relation between **Frontinus** and Vitruvius is treated in detail by **Schultz** in the above-mentioned pamphlet, and recently by **Paul Tannery**, in *Revue de Philologie*, XXI (1897), p. 118 ff. They both agree that Vitruvius commits such grave blunders in his superficial calculations that he cannot really have had anything at all to do with hydraulic architecture. So it would be sufficient to refer those who wish to examine this matter more closely, to these competent authors. Still I will remind the reader that on p. 14 I have called attention to one of the most prominent of these blunders. I will further invite the reader to consider specially the passage which has led to the conclusion that Frontinus must have made use of Vitruvius. It is in his first book, § 24 f., that Frontinus speaks of the measures used in aqueducts. In ancient times, he says, they were measured either by *digiti* (fingers, $=\frac{1}{16}$ ft.), or by *unciæ* (inches, $=\frac{1}{12}$ ft.). Later on, he continues, a new measure was introduced either by Agrippa, according to some authorities, or by the plumbers under Vitruvius, according to others, and this measure became the one used exclusively in the city of Rome. Its name was *quinaria*, a name which those who attributed the name to Agrippa explained from the fact that the quantity of water had increased fivefold, whereas those who put the invention down to Vitruvius and the plumbers derived it from the structure of tubes which were formed of curved leaden plates, five fingers broad. Frontinus himself thinks it due to the length of the diameter of the tube, which measured *quinque quadrantes*, viz. $\frac{5}{4}$ *digiti*, as *senaria* means $\frac{6}{4}$, *septenaria* $\frac{7}{4}$ &c., up to *vicenaria*, $\frac{20}{4}$. ("Postea modulus inductus, ut quidam putant ab Agrippa, ut alii a plumbariis per Vitruvium architectum, in usum urbis exclusis prioribus venit, appellatus quinariæ nomine. Qui Agrippam auctorem faciunt, dicunt quod . . . . qui Vitruvium et plumbarios, ab eo quod plumbea lammina plana quinque digitorum latitudinem habens circumacta in rotundum hunc fistulæ modulum efficiat. Sed . . . . maxime probabile est quinariam dictam a diametro quinque quadrantum, quæ ratio in sequentibus quoque modulis usque ad vicenariam durat diametro per singulos adiectione singulorum quadrantum crescente, ut in senaria, quæ VI quadrantes in diametro habet, et septenaria, quæ VII, et deinceps simili incremento usque ad vicenariam.") Pliny has the same explanation which Frontinus attributes to Vitruvius, yet without mentioning the latter as authority: "denaria appellatur, cuius lamnæ latitudo, ante quam curvatur, digitorum X est, dimidioque eius quinaria" (XXXI, 58). In our Vitruvius VIII, 7 (6), 4, it is said that the tube is named after the breadth of the plate of which it is formed, so that if the plate measures 50 digiti in breadth, the tube is called quinquagenaria. ("E latitudine autem lamnarum quot digitos habuerint, antequam in rotundationem flectantur, magnitudinum ita nomina concipiunt fistulæ; namque quæ lamna fuerit digitorum L, cum fistula perficietur ex ea lamna, vocabitur quinquagenaria, similiterque reliquæ.") This, indeed, is analogous with the passages of Pliny and of Frontinus; but if the text of Vitruvius had been the original one, how could it possibly be that the two other authors separately should have deviated from it in the same way, each basing his calculation on quinaria instead of quinquagenaria? No, it is Vitruvius who has had Pliny or a similar text before him, and, in order to show his independence, has continued the calculation without suspecting what we learn from Frontinus, § 29, that where 20, vicenaria, is exceeded, a different way of calculation must be applied to the larger measures. Mr. Krohn, who in *Berliner Philologische Wochenschrift*, June 19, 1897, has reviewed the first edition of the present pamphlet, attempts to save Vitruvius by supposing a mistake in the manuscripts; L is to be changed to V, and quinquagenaria to quinaria. Such a proceeding of course puts an end to any possible criticism.[1]

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[1] Many who will be born after our time will feel as if they were talking personally with Lucretius about nature, with Cicero about rhetoric, and with Varro about the Latin tongue.

As a matter of fact, then, Frontinus knows an architect of the name of Vitruvius, but he does not mention him as an author, and it cannot possibly be the work which we possess which lay before him. PLINY, on the contrary, knows an author of the name of Vitruvius. He mentions him among his sources to the numbers 16, 35, and 36 of his books. Now the question is whether this is the same Vitruvius as ours. In general there has been no doubt about it, and Dethlefsen, who has gained credit by his edition of Pliny, has undertaken to prove this identity in *Philologus* (1872). There is a great difference between the style and diction of Vitruvius and of Pliny. The former is broad and loquacious, the latter so concise as to become not unfrequently indistinct. Now then, he is supposed to give a compendium of Vitruvius. Dethlefsen allows that Pliny, in all his brevity, contains important facts which are not found in Vitruvius, "but," he says, "those facts he has drawn from another source," and he thinks that Pliny has determined his own value in calling himself a mosaic-like compound of notes drawn from sources all round. However, this is not the case at all. In the passage quoted (Præf. 17), he only says that he has drawn his material from a great number of different works, and the parts described by Dethlefsen as clauses introduced from elsewhere do not appear as such at all, but are found exactly in their right place, in perfect organic connection with the preceding and the succeeding parts. Here is no mosaic; it is all of one piece, and as it contains things which are not found in Vitruvius, it is as clear as day that Pliny has given no extract of him. Dethlefsen means that Pliny has used Vitruvius not only in the three books in which he owns to this fact himself, but also in the Books 31 and 33. Here there is still less resemblance, and even Krohn, who otherwise shares his views, confesses that this is out of the question. Therefore in the following remarks we will abide by Books 16, 35, and 36. Besides, all that concerns the aqueducts is said above.

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[1] Neither is the passage written thus in the "recently found" Schlettstadter MS., a manuscript the value of which, by the way, is very doubtful. Anyhow we ought not to adopt the correction which K. proposes according to this document in the above-mentioned passage, "uti magnitudinem ita nomina" instead of "magnitudinum ita nomina," which is quite intelligible and agreeing with the author's way of expressing himself.

In his Book XVI Pliny speaks of the trees and their wood, and Theophrastus is his principal authority. But there is one, the larch-tree, *larix*, which Theophrastus does not know. Pliny, however, includes it in his account and describes its qualities in §§ 43 and 45; but he does not know the story told by Vitruvius above on p. 11, that it was discovered by Cæsar. He too had heard that it could not burn: "nec ardet nec carbonem facit nec alio modo ignis vi consumitur quam lapides" (it neither burns nor forms charcoal nor is consumed by the power of fire otherwise than stones). In Vitruvius II, 9, 14 we read: "flammam ex igni non recipit nec ipsa per se potest ardere, nisi uti saxum in fornace ad calcem coquendam aliis lignis uratur" (It cannot burn unless it be kindled by other wood, like stones in an oven where chalk is being burnt). Now, is it Pliny who in this place has abridged Vitruvius, putting *lapides* instead of *saxum*, though elsewhere he makes a distinct difference between the two words (comp. XXXVI, 169: "lapis non saxum est")? Nay, has he even meant the same thing? Is it not much more likely that the latter, not understanding Pliny's words, guessed that he meant chalk-burning?

In 196 of the same book Pliny says: "Abietis quæ pars a terra fuit, enodis est. Hæc qua diximus (§ 186) ratione fluviata decorticatur (MS. decoratur) atque ita sappinus vocatur, superior pars nodosa duriorque fusterna."[1] With this compare Vitruvius, II, 9, 7: "Ex ea (sc. abiete), quæ pars est proxima terræ per radices recipiens ex proximitate umorem enodis et liquida efficitur; quæ vero est superior, vehementia caloris eductis in aera per nodos ramis, præcisa alte circiter pedes XX et perdolata propter nodationis duritiam dicitur esse fusterna. Ima autem cum excisa quadrifluviis disparatur eiecto torulo ex eadem arbore ad intestina opera comparatur et sappinea vocatur."[2] Vitruvius, as usual, is more long-winded than Pliny, and his addition *quadrifluviis*, &c., is incomprehensible. That Pliny's short and clear description should be an abridgment of Vitruvius is most unlikely, and is not rendered more probable by Dethlefsen's bold hypothesis that the mistaken word *decoratur* in Pliny's manuscripts is not meant for *decorticatur*, as the editors have been perfectly justified in writing, but *detoratur*, a non-existing word which he has formed from Vitruvius' *eiecto torulo*.

Pliny continues, § 196: "Et in ipsis autem arboribus robustiores aquiloniæ partes, et in totum deteriores ex umidis opacisque, spissiores ex apricis ac diuturnæ; ideo Romæ infernas abies supernati præfertur."[3] Vitruvius II, 9, 17 writes: "Insequitur animadversio, quid ita quæ in urbe supernas dicitur abies deterior est, quæ infernas egregios in ædificiis ad diuturnitatem præstat usus," and subsequently gives an elaborate explanation of these terms taking up a whole page, which was quite superfluous in the first century of our era, when every Roman knew that "mare superum" meant the Adriatic Sea, "mare inferum" the Tyrrhenian Sea, and that "supernas" meant what came from beyond the Apennines, "infernas" what came from this side. To Vitruvius this was something new; it was not known in his home-country, only in Rome, in "urbe."

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[1] The lower part of the *abies* has no knots; it is stripped of its bark after having been kept in water in the way described above, and then it is called *sappinus*. The upper part is knotty and also harder; its name is *fusterna*.

[2] The part which is nearest to the soil gets fluid and without knots, because it draws its moisture immediately from the ground by its roots. But in its upper part the strong heat makes it put forth many knots and branches. If cut and hewn at a height of about twenty feet, this upper part is called *fusterna*, because of its hard knots; the other, lower part of the stem is named *sappinus*.

[3] But those of the trees that grow towards the

Pliny observes, § 197, that on the whole there is a difference between the trees of the different countries, and gives some examples which are not found in Vitruvius. Further: "Cedrus in Creta, Africa, Syria laudatissima; cedri oleo peruncta materies nec tineam nec cariem sentit. Iunipero eadem virtus quæ cedro; vasta hæc in Hispania, maximeque Vaccæis."[1] Vitruvius has, § 13: "Item cedrus et iuniperus easdem habent virtutes et utilitates, sed quemadmodum ex cupresso et pinu resina, ex cedro oleum, quod cedreum dicitur, nascitur, quo reliquæ res cum sunt unctæ, uti etiam libri, a tineis et carie non læduntur. Arboris autem eius est similis cupresseæ foliatura, materies vena directa. Ea Ephesi in æde simulacrum Dianæ, etiam lacunaria et ibi et in ceteris nobilibus fanis propter æternitatem sunt facta. Nascuntur autem eæ arbores maxime Cretæ et Africæ et nonnullis Syriæ regionibus."[2] Vitruvius muddles the cedar and the juniper tree together, supposing them to grow in the same places, while Pliny says that the former grows in Crete, Syria and Africa, the latter in the north of Spain. And further, if Pliny says that cedar-oil can preserve timber against worms, Vitruvius states that it preserves everything else—including books. The latter statement is correct, but it has nothing to do with the subject in hand; it betrays that the man had more to do with books than with buildings. What he adds about the temple of Diana in Ephesus, corresponds with Pliny § 213, but is also incorrect. Pliny has: "convenit tectum eius esse e cedrinis trabibus; de simulacro ipso deæ ambigitur; ceteri ex ebeno esse tradunt, Mucianus III cos., ex his, qui proxime viso eo scripsere, vitigineum."[3] Vitruvius says that the image was of cedar-wood, whereas Pliny, who is more conscientious, states that it was generally said to be of ebony, and Mucianus said it was vine-wood. That Pliny does not summarise Vitruvius is evident; but nothing prevents us from supposing that Pliny is the source of Vitruvius.

Pliny § 218 f.: "Fagus et cerrus celeriter marcescunt; æsculus quoque umoris impatiens; contra adacta in terram in palustribus alnus æterna onerisque quantilibet patiens; cerasus firma; ulmus et fraxinus lentæ, sed facile pandantur, flexiles tamen stantesque ac circumcisura siccatæ fideliores."[4] The same in Vitruvius II, 9, 9 ff., but, as usual, in a different order and spun out, especially by adding silly physical explanations: "Æsculus, quod est

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north are stronger than the others, and generally those growing in damp and shady places are not so good: those which come from sunny countries have more massive wood and last longer. For this reason in Rome the *abies infernas* is preferred to the *supernas*.

[1] The cedars from Crete, Africa and Syria are the most appreciated. The wood which is spread over with cedar oil neither gets worm-eaten nor rots. The juniper shares this quality with the cedar. It grows to a large size in Spain, especially in the country of the Vaccæans.

[2] The cedar and the juniper have the same qualities to recommend them; but whereas the cypress and the fir yield resin, the cedar secretes oil which is called cedar oil, and which preserves books and other things on which it is spread from worms, and from rottenness. The leaves of this tree resemble cypress leaves. The veins in its wood run straight. In the temple of Diana in Ephesus the statue (of the goddess) as well as the ceiling is of cedar, which here, as in many other famous temples, is used because of its durability. Those trees grow particularly in Crete, in Africa, and in some parts of Syria.

[3] It is granted that its ceiling was of cedar. As to the statue of the goddess, it is not known for certain what wood it was made of. Most authorities say it was of ebony. Mucianus, who had been a consul three times, and was one of the last visitors to the temple, declares it to be of vine-wood.

[4] The *cerrus* and the beech decay rapidly. The *æsculus* cannot resist water. The alder, on the con-

omnibus principiis temperata, habet in ædificiis magnas utilitates, sed ea, cum in umore collocatur, recipiens penitus per foramina liquorem eiecto aere et igni operatione umidæ potestatis vitiatur. Cerrus et fagus . . . celeriter marcescunt."[1] After which something similar is added about populus, salix, tilia, vitex, with which experts no doubt willingly dispense, but we miss Pliny's "cerasus firma." Further: "Alnus autem, . . . in palustribus locis infra fundamenta ædificiorum palationibus crebre fixa . . . permanet immortalis ad æternitatem et sustinet immania pondera structuræ" &c.[2] We see, this is quite the same as in Pliny, with the only difference that he uses the technical expression *palatio*, pilework, which he knew from his homestead, Ravenna, the last capital of the Roman empire: "est autem maxime id considerare Ravennæ, quod ibi omnia opera et publica et privata sub fundamentis eius generis habent palos."[3] He continues: "Ulmus vero et fraxinus . . . sunt in operibus cum fabricantur lentæ et ab pondere umoris non habent rigorem et celeriter pandant; simul autem vetustate sunt aridæ factæ aut in agro, proiecto qui inest eis liquore, stantes emoriuntur, fiunt duriores, etc."[4]

Thus there can be no doubt that if Pliny, as he says, has used Vitruvius among his sources for the sixteenth book, it is not the author whom we know by this name, as our Vitruvius is much more likely to have taken from Pliny, though not always in the most successful way.

Pliny XXXV, 170–73 corresponds with Vitruvius II, 3 and 8. The question is about bricks. Pliny: "Lateres non sunt ex sabuloso neque harenoso multoque minus calculoso ducendi solo, sed e cretoso et albicante aut ex rubrica vel etiam e sabulo, masculo certe."[5] Nearly so Vitruvius: "De lateribus, qua de terra duci eos oporteat, dicam. Non enim de harenoso neque calculoso luto neque sabulone soluto sunt ducendi." Then, as usual, follows a rather superfluous explanation. He continues: "faciendi autem sunt ex terra albida cretosa sive de rubrica aut etiam masculo sabulone," adding the reasons in his usual way. Pliny goes on: "Finguntur optime vere, nam solstitio rimosi fiunt."[6] Vitruvius: "Ducendi autem sunt per vernum tempus et autumnale, ut uno tenore siccescant, qui enim per solstitium parantur . . . rimosi facti efficiuntur imbecilli."[7] We see, this is about the same as in Pliny, only with some scarcely felicitous additions, not to speak of the lengthy argumentation which we have left out. There is this difference: that Vitruvius also makes bricks in autumn—which must be his own business; as a rule it is not done. Pliny continues: "Ædificiis non nisi bimos probant."[8] Vitruvius likewise: "Maxime autem utiliores sunt,

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trary, when rammed down into a marshy soil, lasts for ever, and can bear all weights with which it is charged. The cherry-tree is strong, the elm and ash are pliable; still they are appreciated on account of this very quality, and their wood improves if dried before they are felled by letting off its moisture through deep cuts all round penetrating to the marrow.

[1] The Italian oak is very useful in buildings because it is mixed of all elements, but when put in moisture it absorbs the liquid through its pores, and air and fire are expelled, wherefore it is damaged by the operation of the wet power. The Turkey oak and the beech decay quickly.

[2] In marshy places the alder is frequently used for pilework under the foundation of buildings; it is almost imperishable and bears enormous weights.

[3] This may be seen particularly in Ravenna, because all public and private buildings there have piles of that kind beneath their substructures.

[4] The elm and the ash are tough, and because of their superabundant moisture they are not hard, but when used in buildings they soon bend under their weight. But if they are dry from age, or if before being felled they have been cut so as to make all humidity come out, and to be quite dead, they become harder.

[5] The clay of which bricks are formed must not be sandy or gravelly, still less full of pebbles, but it must be chalky and whitish or red, or if sandy, it must be powerful.

[6] It is the best time to make them in spring, for at midsummer they are apt to crack.

[7] They ought to be made in spring and in autumn in order to dry uninterruptedly, for those that are made in midsummer . . . get cracks and become chippy.

[8] They are not suitable for buildings before being two years old.

si ante biennium fuerint ducti." And further, after an elaborate explanation: "Uticenses latere, si sit aridus et ante quinquennium ductus, cum arbitrio magistratus fuerit ita probatus, tum utuntur in parietum structuris."[1] Can anybody believe this? And can an unbiassed reader consider the short and clear account of Pliny as a compendium of the lengthy, partly erroneous, and unreasonable description of Vitruvius? Must we not find it much more probable that the latter has transcribed and drawn out Pliny?

Plin. XXXV, 171: "Genera laterum tria: Lydium, quo utimur, longum sesquipedem, latum pedem, alterum tetradoron, tertium pentadoron; Græci enim antiqui doron palmum vocabant et ideo dora munera, quia manu darentur; ergo a IV et V palmis prouti sunt, nominantur; eadem est et latitudo. Minore privatis operibus, maiore in publicis utuntur in Græcia."[2]

Vitruvius II, 3, 3: "Fiunt autem laterum genera tria, unum quod græce Lydium appellatur, id est quo nostri utuntur, longum sesquipede, latum pede; ceteris duobus Græcorum ædificia struuntur. Ex his unum pentadoron, alterum tetradoron dicitur; doron autem Græci appellant palmum, quod munerum datio græce doron appellatur, id autem semper geritur per manus palmum; ita quod est quoquo versus V palmorum pentadoron, quod IV tetradoron dicitur, et quæ sunt publica opera pentadorois, quæ privata tetradorois struuntur. Fiunt autem cum his lateribus semilateria, quæ cum struuntur, una parte lateribus ordines, altera semilateres ponuntur." We see this is quite the same, only with a few awkward circumlocutions in Vitruvius ("munerum datio" and "semper geritur"). Of his own he has added a passage which Pliny has not, in which he says that bricks of half-size were also used, and where they were found they formed every second course.

Pliny goes on: "Pitanæ in Asia et in ulteriore Hispania civitatibus Maxilua et Calle fiunt lateres, qui siccati non merguntur in aqua; sunt enim e terra pumicosa, cúm subigi potest, utilissima."[3] Vitruvius, § 4: "Est autem in Hispania ulteriore civitas Maxilua item Calle, in Asia Pitane, ubi lateres cum sunt ducti et arefacti, proiecti natant in aqua. Natare autem eos posse ideo videtur quod terra est de qua ducuntur pumicosa." We see, the correspondence is complete; Vitruvius only adds a lengthy and quite superfluous explanation.

It is further related by Pliny in XXXV, 172, that if the Greeks had no hard stones at their disposal, they preferred brick-walls, for, he adds—these are imperishable if only they are perpendicular, "latericios parietes prætulere; sunt enim æterni, si ad perpendiculum fiant." Vitruvius in II, 8, 8 tells us that in valuing houses made of rough stone, it is presupposed that they cannot last longer than eighty years, and in basing the calculation on the sum representing the building expenses, $\frac{1}{80}$ is deducted for each year the house has existed. In connection with this statement he adds in § 9: "De latericiis vero, dummodo ad perpendiculum sint stantes, nihil deducitur, sed quanti fuerint olim facti, tanti esse semper æstimantur."[4] This, we see, corresponds with the beginning of the passage in Pliny.

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[1] The people of Utica do not use the bricks for building till they are dry and five years old and have been approved of by the magistrates.

[2] There are three kinds of bricks, Lydian bricks which we use, 1½ ft. long, 1 ft. broad; the second kind is tetradoron, the third pentadoron. The fact is that the ancient Greeks called the breadth of the hand (the four fingers) doron, and they called a gift doron, because it is given with the hand; so the bricks are named according to their size, whether four or five breadths of a hand; they are as broad as they are long. In Greece the smaller size is used in private buildings, the larger size in public ones.

[3] In Pitane in Asia and in the towns of Maxilua and Calle in the more distant part of Spain bricks are made which, if quite dry, do not sink in water. They consist of a pumice-stone-like clay which is very useful when it can be kneaded.

[4] But in valuing brick buildings nothing is deducted. If perpendicular, they are valued at the sum spent in building them.

Pliny continues: "Ideo et publica opera et regias domos sic struxere, murum Athenis qui ad montem Hymettum spectat, Patris ædes Iovis et Herculis, quamvis lapideas columnas et epistylio circumdarent, domum Trallibus regiam Attali, item Sardibus Crœsi, quam gerusiam fecere, Halicarnassi Mausoli, quæ etiam nunc durat. Lacedæmone quidem latericiis parietibus excisum opus tectorium propter excellentiam picturæ ligneis formis inclusum Romam deportavere in ædilitate ad comitium exornandum Murena et Varro; cum opus per se mirum esset, tralatum tamen magis mirabantur. In Italia quoque latericius murus Areti et Mevaniæ est."[1] Compare with the above Vitruvius II, 8, 9, f.: "Itaque nonnullis civitatibus et publica opera et privatas domos etiam regias e latere structas licet videre, et primum Athenis murum qui spectat ad Hymettum montem et Pentelensem, item Patris in æde Iovis et Herculis latericias cellas, cum circa lapidea in æde epistylia sint et columnæ, in Italia Arretio vetustum egregie factum murum, Trallibus domum regibus Attalicis factam, quæ ad habitandum semper datur ei qui civitatis gerit sacerdotium. Item Lacedæmone e quibusdam parietibus etiam picturæ excisæ intersectis lateribus inclusæ sunt in ligneis formis et in comitium ad ornatum ædilitatis Varronis et Murenæ fuerunt adlatæ. Crœsi domus, quam Sardiani civibus ad requiescendum ætatis otio, seniorum collegio gerusiam dedicaverunt. Item Halicarnasso potentissimi regis Mausoli domus cum Proconnesio marmore omnia haberet ornata, parietes habet latere structos, etc."

The correspondence is so great that either both authors must have drawn their knowledge from the same source, or one of them must have copied the other. In the latter case Pliny must be the original. Vitruvius explains the word *gerusia* erroneously, as if it were a charitable institution, a home for old men, whereas Pliny has no doubt that his readers know it means the council of ancients. While Pliny speaks of two temples in Patræ, Vitruvius combines them into one, a gross negligence; in Greece we find no place where Zeus and Heracles are worshipped in common. He leaves out Mevania, probably not knowing this little Umbrian town. In the passage about Athens he mentions Pentelicon as well as Hymettus, and he says that the palace in Tralles has become the official residence of the priest, both of which may quite well be inventions of his own. That Proconnesian marble was used for the palace of Halicarnassus is stated by Pliny (XXXV, 47). The corresponding passage in Vitruvius is followed by a long amusing digression about Halicarnassus and Artemisia, which has nothing whatever to do with the subject in hand. We do not know whence the author got his information; let us hope it is reliable. Then he returns to Pliny, who says: "Romæ non fiunt talia ædificia, quia sesquipedalis paries non plus quam unam contignationem tolerat, cautumque est ne communis crassior fiat, nec intergerivorum ratio patitur."[2] Vitruvius II, 8, 16: "Id genus quid ita a populo Romano in urbe fieri non oporteat, exponam, quæque sint eius rei causæ et rationes non prætermittam. Leges publicæ non patiuntur maiores crassitudines quam sesquipedales constitui loco communi. Ceteri autem parietes, ne spatia angustiora fiant, eadem crassitudine collocantur; latericii vero, nisi diplinthii aut triplinthii fuerint, sesquipedali crassitudine non possunt plus unam sustinere contignationem." We see this is almost the same.

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[1] And for this reason public buildings as well as royal palaces were built thus [viz. of brick]: in Athens the wall facing Mount Hymettus; in Patræ the temples of Jupiter and of Hercules, which, however, were surrounded by pillars and architraves of stone; in Tralles the royal palace of Attalus; likewise in Sardes the palace of Crœsus, which has been transformed into a gerusia, and in Halicarnassus the palace of Mausolus, which is still in existence. In Lacedæmon, where admirable paintings were found on the stucco coating of brick walls, plates of this stucco were cut off, provided with wooden frames and carried to Rome, in order to adorn the Comitium during the edileship of Murena and Varro; though the work itself was wonderful, the fact that it could be moved was even more to be wondered at. Also in Italy, the walls of Arretium and of Mevania are of brick.

[2] In Rome such houses are not built, because a wall which is 1½ ft. broad cannot bear more than one storey, and because it is a rule that a common wall must not be thicker, which rule also applies to partition walls.

In Book XXXVI Pliny speaks of natural stones. In § 166 he begins to talk about the soft tufa which is no good material, but which has to be used where nothing else is to be had, as in Carthage. After which comes this passage: "Alia mollitia circa Romam Fidenati et Albano. In Umbria quoque et Venetia albus lapis dentata serra secatur. Hi tractabiles in opere laborem quoque tolerant, sub tecto dumtaxat; aspergine et gelu pruinisque rumpuntur in testas, nec contra auram maris robusti; Tiburtini ad reliqua fortes vapore dissiliunt."[1] Herewith corresponds Vitr. II, 7, 1–2: "Sunt aliæ molles, uti sunt circa urbem Rubræ [sc. lapicidinæ], Pallenses, Fidenates, Albanæ, aliæ temperatæ uti Tiburtinæ, Amiterninæ, Soractinæ et quæ sunt his generibus, nonnullæ duræ, uti siliceæ. Sunt etiam alia genera plura ut in Campania ruber et niger tofus, in Umbria et Piceno et in Venetia albus, qui etiam serra dentata uti lignum secatur. Sed hæc omnia, quæ mollia sunt, hanc habent utilitatem, quod ex iis saxa cum sunt exempta in opere faciliter tractantur. Et si sunt in locis tectis, sustinent laborem, si autem in apertis et patentibus, gelicidiis et pruina in testas[2] friantur et dissolvuntur. Item secundum oram maritimam ab salsugine exesa diffluunt neque perferunt æstus. Tiburtina vero et quæ eodem genere sunt omnia sufferunt et ab oneribus et a tempestatibus iniurias, sed ab igni non possunt esse tuta simulque sunt ab eo tacta dissiliunt et dissipantur." We see that Vitruvius in his prolixity does not give any more than Pliny in his conciseness, except a few occasional additions (*Rubræ*, *Pallenses*, *Amiterninæ*, *in Campania ruber et niger tofus* and *Piceno*), which make it seem probable that he has not drawn his information from Pliny, but from the same author who was used by Pliny. He commits a mistake in writing *æstus* instead of *aura*, as this word does not mean the sea-air but the breakers of the sea.

In § 168 Pliny passes on to the hard stones, *silex*: "Nigri silices optimi, quibusdam in locis et rubentes, nonnusquam vero et albi, sicut in Tarquiniensi Anicianis lapicidinis, circa lacum Volsiniensem et in Statonensi, quibus ne ignes quidem nocent. Iidem in monumentis scalpti contra vetustatem quoque incorrupti permanent; ex iis formæ fiunt, in quibus æra funduntur."[3]

Vitruvius II, 7, 3 f.: "Sunt vero item lapicidinæ complures in finibus Tarquiniensium, quæ dicuntur Anicianæ, colore quemadmodum Albanæ, quarum officinæ maxime sunt circa lacum Volsiniensem, item præfectura Statonensi. Hæc autem habent infinitas virtutes. . . . . Id autem maxime iudicare licet e monumentis, quæ sunt circa municipium Ferenti ex his facta lapicidinis. Namque habent et statuas amplas factas egregie et minora sigilla floresque et acanthos eleganter scalptos. Quæ cum sint vetusta, sic apparent recentia uti si sint modo facta. Non minus etiam fabri ærarii de his lapicidinis in æris flatura formis comparatis habent ex iis ad æs fundendum maximas utilitates."

This, too, resembles Pliny, but there are several absurdities. Tarquinian stone-quarries cannot be situated near the lake of Bolsena, and Statonia never was the seat of a prefect.

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[1] Other soft stones are found in the country about Rome, the Fidenatian and the Albanian stones. In Umbria and Venetia also there is a white stone which has to be cut with a saw. These stones are easy to work with, and yet they are durable, at all events when covered by a roof; in rain, frost and rime they burst, nor can they resist the sea-fog. The Tiburtine stones can stand other influences, but crack if exposed to steam.

[2] Thus corrected in *Philologus*, xxxi. p. 415. The MSS. have "congesta."

[3] The black lava-stones are the best; sometimes they are also reddish, in some places also white, as in the Anician quarries near Tarquinii, round the lake near Volsinii, and in the country about Statonia; they are not even damaged by fire. In sculptures on monuments these stones keep well and stand the test of time; they are also used to make moulds of in bronze-foundries.

That a large statue should have been made of lava is incredible and unheard of; Pliny evidently speaks of ornamental sculpture only.

What Pliny has in § 169 is not mentioned in Vitruvius. He continues in § 170: "Remedium est in lapide dubio æstate eum eximere nec ante biennium inserere tecto domitum tempestatibus. Quæ ex eo læsa fuerint, subterraneæ structuræ aptentur utilius; quæ restiterint, tutum est vel cælo committere."[1] Vitruvius (chap. 7, 5) has the same, but with the addition that this test ought to be applied not only to square stones, but also to irregularly shaped smaller stones: "Nec solum ea in quadratis lapidibus sunt observanda sed etiam in cæmenticiis structuris." However, it does not seem very probable that so much care should have been taken with such inferior material.

Pliny § 171: "Græci e lapide duro aut silice æquato struunt velut latericios parietes."[2] Vitruvius II, 8, 5: "cum discesserint a quadrato, ponunt de silice seu lapide duro ordinario."[3] What, then, does he mean in excepting *quadratum?* It is exactly to square-stone buildings that the following lines apply: "Hæc duobus generibus struuntur. Ex his unum isodomum, alterum pseudisodomum appellatur. Isodomum dicitur, cum omnia coria æqua crassitudine fuerint structa, pseudisodomum cum impares et inæquales ordines coriorum diriguntur."[4] Pliny says the same thing: "Cum ita fecerunt," viz. in building them like brick walls, with all layers of equal thickness, "isodomon vocant genus structuræ, et cum inæquali crassitudine structa sunt coria, pseudisodomon." He goes on: "Tertium est emplecton tantummodo frontibus politis; reliqua fortuitu conlocant."[5] He adds that such walls have to be strengthened by binders alternately from each side. Vitruvius says nearly the same in § 7, but his description is rather confused.

In the following passage Pliny is not quite clear, in some parts even corrupt. The same applies even to Vitruvius, so that a comparison becomes difficult. Pliny concludes as follows: "Reticulata structura, qua frequentissime Romæ struunt, rimis opportuna est."[6] Vitruvius writes (chap. 8, 1): "Structurarum genera sunt hæc, reticulatum, quo nunc omnes utuntur, et antiquum, quod incertum dicitur. Ex his venustius est reticulatum, sed ad rimas faciendas ideo paratum, quod in omnes partes dissoluta habet cubilia et coagmenta. Incerta vero cæmenta alia super alia sedentia inter seque imbricata non speciosam, sed firmiorem quam reticulata præstant structuram."[7] We will not stop to consider the awkward way in which Vitruvius expresses himself, we will only observe that if he had been Pliny's authority, the latter could not possibly have avoided mentioning this "uncertain" method of building, which is absolutely preferred by the former.

In his § 174 Pliny says: "Calcem e vario lapide Cato Censorius improbat; ex albo melior. Quæ ex duro structuræ utilior, quæ ex fistuloso tectoriis; ad utrumque damnatur ex silice."[1] Vitr. II, 5, 1: "De calce diligentia est adhibenda uti de albo saxo aut silice coquatur. Et quæ erit ex spisso et duriore, erit utilis in structura, quæ autem ex fistuloso, in tectoriis." Here we notice the curious difference that while Pliny absolutely condemns burning chalk of silex, Vitruvius thinks it will do as well as white limestone.

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[1] If doubts are entertained as to the durability of the stones, their quality is tested in the following way: they are cut in the summer, but not used for building till two years after, in the meantime having been exposed to the atmospheric changes, after which the damaged stones are used for the subterranean parts of the edifices; those that are unimpaired can safely be exposed to the influence of the air.

[2] The Greeks construct walls of hard stone or of regularly cut lava in the same way as brick walls.

[3] When they renounce the square stones they build of lava or of ordinary hard stones [*ordinaria* in the text must be a mistake, comp. § 4: "ex silicibus ordinariis"].

[4] These are of two kinds, isodomum and pseudisodomum: the former, in which all the courses are equally thick; the latter, in which they are of unequal thickness.

[5] The third kind is emplecton, where the front sides only are regularly built, while in the remaining parts the stones are placed just as they may happen to fit.

[6] Reticulated work, which is so frequently used in Rome, is apt to crack.

[7] There are two kinds of building: reticulated work, which is now used by all, and the old kind, called the uncertain. Reticulated work is the finest, but it will easily crack, because the stones are loosely placed and connected; irregular pieces which fit in between each other do not produce a fine building, but they have more firmness than the network.

If Vitruvius is very brief in his remarks about the chalk, he goes much more into detail where he speaks about the sand with which the chalk has to be mixed (book II, 4). Pliny (§ 175) is as summary here as elsewhere; still he has one observation which Vitruvius has not: namely, that pit-sand (*harena fossicia*) is not found in the country between the Apennines and the river Po.

Pliny teaches us (§ 173) how the walls and bottoms of cisterns ought to be covered with a well stamped coat of cement consisting of five parts of pure sand and two parts of pure chalk mixed with stones none of which ought to weigh more than one pound. A similar passage is found in Vitruvius (VIII, 7 [6], 14–15); only he does not speak of cisterns, which are not even mentioned in his work, but of well-sinking. It is the walls and bottoms of wells which he covers with the above-mentioned cement, giving it the name of *opus signinum* After having described this proceeding in his usual way, he seems to forget what he has been talking about, and while Pliny makes the following correct remark about cisterns, "Utilius geminas esse, ut in priore vitia considant atque per colum in proximam transeat pura aqua,"[2] Vitruvius writes thoughtlessly (VIII, 7, 15): "Ea si duplicia aut triplicia facta fuerint, uti percolationibus transmutari possint, multo salubriorem et suaviorem aquæ usum efficient, etc."[3] This is quite incomprehensible. The author himself did not understand what he was talking about. What does he mean by *ea*, and what things are to be changed by sifting?

Pliny says (§ 178 f.): "There are four kinds of columns. Those whose bottom diameter is ⅙ of their height are called Doric; if it is ⅑, they are Ionic, if ⅐, Tuscan. The Corinthian columns are like the Ionic, only differing from them in the height of their capital, which equals the lowest diameter of the pillars, thus giving them a more slender appearance. The Ionic capital is only one-third of the diameter of the column. The ancient proportions required the height of the columns to be one-third the breadth of the temple. In the oldest temple of Diana in Ephesus the columns were for the first time constructed on bases, and provided with capitals, and it was agreed to fix their diameter at ⅛ of their height, and the height of the base at half their diameter; the top of the pillar was to be ⅐ thinner than the bottom. Finally, there are the so-called Attic columns, whose capitals have four equal sides and angles" (viz. Ionic angular capitals). We may criticise this paragraph: for instance, the statement that spiræ and capitals were first invented in Ephesus; we may find it too short and incomplete; but, to be sure, Detlefsen must have been very prejudiced when (p. 146) he calls it "ein wahres Wirrwarr," and complains of repetitions where there are none at all, and if "nowhere more than here he is impressed with the author's mosaic-like composition." Pliny's short paragraph is supposed to be a mosaic of Vitruvius IV, 1, 6. 1, 8. 7, 2. 1, 11. 1, 1. 7, 2. 1, 7. This conclusion is drawn from "der sachlichen und theilweise wörtlichen Uebereinstimmung." As if it were possible to write about the very same things without occasionally using the same words; or as if there must not necessarily be found a similarity of reality in those who proceeded from the same school, and had drawn their knowledge from the same book.

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[1] Old Cato disapproves of chalk made of coloured limestone; it is better when made of white stone. The hard stone is preferable for building, the porous stone for stucco. If made of silex, it is not fit for either.

[2] It is most useful to make two divisions, so that the vicious parts remain in the upper space while the pure water passes through a sieve into the lower one.

[3] If these are made into two or three, so that they may be changed by sifting, they produce healthier and more palatable water.

This book, as we have explained above, must be supposed to be Varro's work *De Architectura.* To Pliny this subject was only of secondary interest, and the notes he has borrowed from it are few and unimportant, while to Vitruvius it was the principal source of information—of course only as far as architecture is concerned: as mentioned above, he includes many other subjects in his work. In the matter of natural history our comparison has shown that Pliny seems to be his most important source. What Pliny owes to the Vitruvius whom he mentions among the sources he used in writing books 16, 33, and 35, we do not know, but he must be a different author from the Vitruvius we know. We should even feel inclined to think that his work did not treat of architecture in particular, if Frontinus had not mentioned Vitruvius the architect, and if Servius had not quoted "Vitruvius de architectonica."

Servius, the grammarian, lived at the close of the fourth century of our era. In his comment on the *Æneid,* VI, 43, he quotes the following lines: "Cum ab aliquo arcemur ingressu, id ostium dicit [Vitruvius] ab ostando, cum ingredimur, aditum ab adeundo." In other words, a door may be called *ostium* and *aditus,* the latter in so far as we enter by it *(adire),* the former in so far as it prevents from entering *(obstare).* Now this passage is not found in the ten books we possess bearing the name of Vitruvius, and yet these books are transmitted to us without a single gap; on the whole, in our Vitruvius we do not find any remark of the kind quoted by Servius and Frontinus. Clearly it is not this author to whom they appeal. Whether Servius himself had read the more ancient genuine author of this name, or had his quotation secondhand from an older grammarian, is quite immaterial.

If Sidonius Apollinaris has also been named as an authority proving the genuineness of Vitruvius, this is a great mistake. He mentions Vitruvius together with Orpheus, Æsculapius and others, not as an author he knew, but as a representative of architecture.[1] And even if Sidonius had seen the book we possess, this circumstance would have been no objection against our statement, as he lived at the close of the fifth century, viz. after the time when we suppose the work to have been written.

IV

If in the previous researches about Vitruvius we can only be said to have arrived at a high degree of probability with regard to the source from which he has drawn the architectonic part of his work, we are more fortunate with the chapters about mechanics, especially those treating of machines of war, in book X. Here we find a considerable part about the origin of which there can be no mistake. Schneider already, in his comment on Vitruvius, III, p. 361, called attention to the striking resemblance between Vitruvius and Athenæus *Περὶ μηχανημάτων,* and Haase, in his article about Philon from Byzantium in the *Encyclopedia* of Ersch and Gruber, p. 429, note 11, declares unhesitatingly that all the chapters 13–15 (19–21), and a good deal more, are borrowed from Athenæus. As long as Athenæus was considered an Alexandrian author, no objection could be made to this statement; but Diels, in his essay about the natural philosopher Straton in *Sitzungsberichte der Berliner Akademie,* 1893, p. 111, note, declares that judging from his style and language, this author can only belong to the second or third century of the Christian era; now, as he shared the general belief that Vitruvius was a contemporary of Augustus, he came to the result that Vitruvius could not have drawn from Athenæus, but that both of them had used the same source. M. Thiel, a younger philologist, followed out this thought more in detail in his disputation for a Doctor's degree in Leipzig in 1895, suggesting Agesistratus, the authority quoted by Athenæus, to be this common source. However, he has been unable to prove the truth of this suggestion, and I have no doubt that a renewed comparison of the corresponding passages in both authors will convince the reader that Vitruvius indeed had Athenæus before him, and partly translated him, of course in his usual fashion, now literally, now negligently and spun out with unnecessary circumlocutions and additions.[1] Well then, who was this ATHENÆUS, and when did he live? He mentions Agesistratus as his nearest predecessor, but we are equally in the dark as to when he lived. He further alludes to Ktesibius, the well-known Alexandrian mechanician, who seems to belong to the third or second century B.C. So far Athenæus could have lived at the close of the third century before our age, and the Marcellus to whom he dedicates his book could have been the well-known conqueror of Syracuse. But of course we can draw no conclusions from this mere name, which was borne by many Romans in later times, and if Hultsch thinks that because Athenæus does not mention Heron he must have lived earlier, it may be observed that even the date of Heron is uncertain. But in looking on Athenæus himself with unprejudiced eyes—viz. without considering Vitruvius—we cannot be in doubt as to the age in which he lived. This appears immediately from the introduction. The author begins with the Delphic precept that we must not waste our time. "Money and everything else can be replaced, but time never. And Homer says: 'To sleep all night long does not behove a king.' Therefore an author who writes with the purpose of being useful must not waste many words and fill his book with excursions, but, as the philosophers say, he must 'know the measure of time.' Explicitness may be useful in impressing the first elements on the beginner, but the practical man requires brevity. Calanus, the Indian, we know, reproached the Greeks with their loquacity. So the author means to be concise like the authors accompanying Alexander the Great and Pyrrhus, who wrote about besieging machines, and he will take care to avoid what happened to Isocrates, who did not finish the letter in which he advised Philip of Macedonia to yield, till the peace had been concluded; he will state briefly what he has learned from Agesistratus." Such an introduction is clearly enough an outcome of the rhetorical sophistry which flourished in the second and third centuries after Christ. The end of the book reveals the same age with still greater evidence. It must, he says, not by any means be supposed that he has written this book in order to teach people to conquer and destroy cities; on the contrary, he only wishes defence against violators; but if defence is to be effective, it is necessary to know the enemy's means of attack. He bears in mind particularly the necessity of being armed AGAINST THOSE WHO WILL NOT SUBMIT TO THE EXCELLENT LAWS OF THE EMPIRE. This is not the language of the third century B.C., when Egypt, Syria, and Macedonia were rival powers, when Rome and Carthage stood against each other, and when Marcellus conquered Syracuse. It is the language of the Empire which acknowledges ONLY ONE SINGLE REALM. In the third century after Christ the Roman says that he will make no conquests, but only wants to keep up peace in the Empire and take care that it is not disturbed by invasions and insurrections, which unfortunately occur but too frequently. So the question is decided even without regarding the language.

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[1] Sidonius Apollinaris IV. 8: "Si fors exigit, tenere non abnuit cum Orpheo plectrum, cum Æsculapio baculum, cum Archimede radium, cum Euphrate horoscopium, cum Perdice circinum, cum Vitruvio perpendiculum."

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[1] Thiel judges him quite correctly (p. 305): "Ne de Vitruvio quidem quidquam restat, nisi ut moneare, qualis eius sit fides, quippe qui ipsum se inspexisse simulaverit quos ex Agesistrato noverat auctores, et quamquam affirmat 'se ad apparationem ballistarum et scorpionum reliquorumque tormentorum refectionem fuisse præsto,' de bellicis machinis docere nescivit nisi Græco auctore ad verbum fere expresso." He only ought to have put Athenæus instead of Agesistratus.

Nor is Diels the first to express this opinion; about 300 years previously CASAUBONUS, in his comment on the biography of Gallienus by Trebellius Pollio (chap. 13), had put forth the very plausible suggestion that the mechanician Athenæus was identical with the Athenæus from Byzantium whom Gallienus entrusted with the task of having the towns which had been destroyed by the Scythians rebuilt and fortified ("instaurandis urbibus muniendisque præfecit"). While a young man he may have written this book to a certain Marcellus; this work might qualify its author for the important office with which he was charged.

We will now present parallels of the chapters by Athenæus which have been used by Vitruvius, and of this author's reproductions, adding an English translation in footnotes.

Vitruvius begins by an introductory sentence which corresponds entirely with the just-quoted epilogue by Athenæus: "Restat mihi de oppugnatoriis rebus quemadmodum machinationibus et duces victores et civitates defensæ esse possint." Though speaking only of besieging machines, he assures the reader that all he wants is to enable the towns to defend themselves.

ATHENÆUS, p. 9, ED. WESCHER.	VITRUVIUS X, 19 (13).
p. 9. *Κριὸν μὲν ἔφασκεν* [sc. Agesistratos] *εὑρεθῆναι πρώτιστον ὑπὸ Καρχηδονίων ἐν τῇ περὶ Γάδειρα πολιορκίᾳ. Χωρίδιον γάρ τι προκαταλαμβανομένων αὐτῶν καὶ καθαιρούντων εἰς ἔδαφος τὰ τείχη νεανίσκους τινὰς οὐθὲν ἔχοντας ἄρμενον εἰς τὴν καθαίρεσιν δοκὸν λαβόντας διὰ χειρῶν ἐνσείειν εἰς τὸ τεῖχος καὶ ῥᾳδίως ἐπὶ πολὺν τόπον καθελεῖν. Ὅθεν συνιδὼν τὸ γενόμενον Τύριός τις ναυπηγὸς ᾧ ὄνομα ἦν Πεφρασμένος, ἐν τῇ πολιορκίᾳ, ἣν ἐποιοῦντο μετὰ ταῦτα πρὸς τὴν τῶν Γαδειριτῶν πόλιν, ἱστὸν στήσας καὶ ἄλλον ἀπ' αὐτοῦ πλάγιον ἀρτήσας παραπλησίως ταῖς τῶν ζυγῶν φάλαγξιν ἔτυπτε τὸ τεῖχος ἕλκων ἐξ ἀντισπάστου τὸν πλάγιον. Ἀπόρως δὲ τῶν ἔνδον διακειμένων διὰ τὸ ξεῖνον τοῦ μηχανήματος συνέβαινεν αὐτὰ πίπτειν ταχέως.*[1]	1. Primum ad oppugnationes aries sic inventus memoratur esse. Carthaginienses ad Gades oppugnandas castra posuerunt. Cum autem castellum ante cepissent, id demoliri sunt conati. Posteaquam non habuerunt ad demolitionem ferramenta, sumpserunt tignum idque manibus sustinentes capiteque eius summum murum continenter pulsantes summos lapidum ordines deiciebant et ita gradatim ex ordine totam communitionem dissipaverunt. 2. Postea quidam faber Tyrius, nomine Pephrasmenos ac ratione, ea inventione inductus malo statuto ex eo alterum transversum uti trutinam suspendit et ita reducendo et impellendo vementibus plagis deiecit Gaditanorum murum.

The translator is faithful enough to the original; he adds only the superfluous remark that the name Pephrasmenos corresponds with the act attributed to him (*ac ratione*).

Γήρας δὲ μετ' αὐτὸν ὁ Καρχηδόνιος ὑπότροχον p. 10. *ποιήσας σχεδίαν ἐπέθηκε πλάγιον τὸν κριὸν καὶ οὐκ ἐξ ἀντισπάστων εἷλκεν ἀλλ' ὑπὸ πλήθους ἀνδρῶν προωθούμενον ἐποίησέ τι ὑπότροχον σκέπασμα.*[2]	Ceras autem Chalchedonius de materia primum basim subiectis rotis fecit supraque compegit arrectariis et iugis varas et in his suspendit arietem coriisque bubulis texit, uti tutiores essent, qui in ea machinatione ad pulsandum murum essent collocati.

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[1] He [Agesistratus] asserts that the Carthaginians were the first to invent the battering ram, in the siege of Gadeira. They had begun by taking possession of a small fortress, and while they were pulling down its walls, some young men, having no other implements of demolition, took a beam, and, swinging it with their arms, battered a considerable part of the wall with it. A Tyrian shipbuilder named Pephrasmenos noticed this, and in the subsequent siege of Gadeira he planted a mast in the ground, and having hung on it another after the fashion of the lever of a balance, he set about striking the wall by making the cross-beam oscillate backward and forward. The besieged not knowing how to counteract this new stratagem, a breach was soon made in the rampart.

[2] Geras the Carthaginian after him constructed a timber frame on wheels, and placed the ram on it crosswise. It was not suspended by ropes so as to

Vitruvius in his negligence makes Geras (Ceras) a Chalcedonian instead of a Carthaginian, and instead of the simple machine moved by hand-power, he speaks of one which works by oscillation, a later invention which was introduced by Diades, as below.

> *Γήρας δὲ πρῶτος ὁ εὑρὼν διὰ τὴν βραδύτητα χελώνην προσηγόρευσεν. Μετὰ ταῦτα δὲ ἐποίησάν τινες ἐπὶ κυλίνδρων προωθούμενον τὸν κριὸν καὶ οὕτως ἐχρῶντο. Ἐπίδοσιν δὲ ἔλαβεν ἡ τοιαύτη μηχανοποιία πᾶσα κατὰ τὴν Διονυσίου τοῦ Σικελιώτου τυραννίδα κατά τε τὴν Φιλίππου τοῦ Ἀμύντου βασιλείαν, ὅτε ἐπολιόρκει Βυζαντίους Φίλιππος. Εὐημέρει δὲ τῇ τοιαύτῃ τέχνῃ Πολύειδος ὁ Θέτταλος, οὗ οἱ μαθηταὶ συνεστρατεύοντο Ἀλεξάνδρῳ, Διάδης καὶ Χαρίας.*[1]

> Ideo autem quod tardos conatus habuerat, testudinem arietariam appellare cœpit.
> 3. His tunc primis gradibus positis ad id genus machinationis, postea cum Phillipus Amyntæ filius 'Byzantium oppugnaret, Polyidos Thettalos pluribus generibus et facilioribus explicavit. A quo receperunt doctrinam Diades et Charias, qui cum Alexandro militaverunt.

Here Vitruvius is shorter than the original. He omits the not unimportant passage that some people used to move the ram on rollers instead of wheels, and he leaves out Dionysius. On the other hand, he is so particular as to retain the Attic form Thettalos instead of Thessalus, the form used exclusively in classic Latin.

> *Διάδης μὲν οὖν αὐτός φησιν ἐν τῷ μηχανικῷ συγγράμματι εὑρηκέναι τούς τε φορητοὺς πύργους καὶ τὸ λεγόμενον τρύπανον καὶ τὸν κόρακα καὶ*
> p. 11. *τὴν ἐπιβάθραν· ἐχρᾶτο δὲ καὶ τῷ ὑποτρόχῳ κριῷ· γράφει γοῦν τὴν κατασκευὴν αὐτοῦ.*[2]

> Itaque Diades scriptis suis ostendit se invenisse turres ambulatorias, quas etiam dissolutas in exercitu circumferre solebat, præterea terebram et ascendentem machinam qua ad murum plano pede transitus esse posset, etiam corvum demolitorem,
> 4. quem non nulli gruem appellant. Non minus utebatur ariete subrotato, cuius rationes scriptas reliquit.

Vitruvius adds, what we can easily imagine, that these movable towers might be taken to pieces, and he explains *ἐπιβάθρα* somewhat in the same way as Athenæus (p. 25). In the text of Athenæus the word *αὐτοῦ* is followed by *οὕτως* and subsequently with capital letters Κ*ρίου κατασκευή*. So it was meant to give a drawing of the ram; however, the figure we see represents the borer, which of course is a mistake. That in this place there is a gap in the text is clearly seen from the subsequent passages, where Athenæus speaks of the small and the large tower, which evidently must have been mentioned previously. Vitruvius has not noticed this and goes on as if nothing were amiss.

> *Τὸν μὲν οὖν πύργον τὸν ἐλάχιστον, φησί, δεῖ γενέσθαι τὸ ὕψος πηχῶν ξ̅, τὸ δὲ πλάτος ἔχοντα πήχεις ι̅ζ̅, συναγωγὴν δὲ τοῦ πλάτους εἰς τὸ ἄνω τὸ πέμπτον μέρος· τῶν δὲ σκελῶν τοῦ πύργου τὰ πάχη ἔχειν κάτωθεν τριπάλαιστα,*

> Turrim autem minimam ait oportere fieri ne minus altam cubitorum LX, latitudinem XVII, contracturam autem summam imæ partis quintam, arrectaria in turris imo dodrantalia, in summo semipedalia. Fieri

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swing backward and forward, but the whole structure, covered by a roof, was wheeled against the rampart by a great number of men.

[1] Geras, the inventor of this machine, gave it the name of Tortoise because of its slowness. Later on other engineers constructed a ram advancing on rollers, and used the machine thus modified. This branch of engineering made great progress during the reign of Dionysius, the tyrant of Sicily, and that of Philip the son of Amyntas, when he laid siege to Byzantium. Among those who were most distinguished in this science is mentioned Polyeidus of Thessaly, whose disciples Diades and Charias accompanied Alexander on his expedition.

[2] Diades in his work on engineering says that he himself was the inventor of the movable towers and of the so-called "*borer*," the "*raven*" and the "*flying bridge*." He also used the ram on wheels: at least he gives a description of it.

ἄνωθεν δὲ ἑπταδάκτυλα. Ἐγένετο δὲ ὁ τηλικοῦτος δεκάστεγος περιπτέρου οὔσης ἑκάστης χώρας.[1]

autem ait oportere eam turrim tabulatorum decem, singulis partibus in ea fenestratis.

The translation is literal; there is only a deviation in the measures. Vitruvius makes 7 fingers ½ foot; in the following paragraph his ½ foot measures 6 fingers. The correct calculation required 8; 4 fingers make a palm, 4 palms 1 foot, and 6 palms an ell or cubitus.

Ὁ δὲ μέγιστος αὐτῶν πύργος τὸ μῆκος εἶχε p. 12. *πήχεις ρκ, τὸ δὲ πλάτος εἶχε πήχεις κγϲ, τὴν δὲ συναγωγὴν καὶ οὗτος τὸ πέμπτον ἐλάμβανεν εἰς τὸ ἄνω μέρος, τῶν δὲ σκελῶν τὰ πάχη ποδιαῖα καὶ κάτωθεν τετράγωνα, εἰς ἓξ δακτύλους τὸ πᾶν συναγόμενα ἐπὶ τὰ ἄνω.*[2]

5. Maiorem vero turrim altam cubitorum CXX, latam cubitorum XXIIIS, contracturam item quinta parte, arrectaria pedalia in imo, in summo semipedalia.

Here also the translator follows the original. He only leaves out the observation that the post ought to be square at the bottom.

Ὁ δὲ τηλικοῦτος αὐτῷ πύργος ἐγένετο εἰκοσάστεγος περιδρόμους ἐχούσης ἑκάστης στέγης κύκλῳ πλάτος γ πηχῶν ἔχοντας εἰς τὴν ἐκβοήθησιν τῶν ἐμπυρισμῶν. Ἡ δὲ πρώτη στέγη ἐχέτω τὸ ὕψος πήχεις ζϲ, ἡ δὲ δευτέρα πέντε, καὶ ἕως πέντε στεγῶν τὸ αὐτὸ ὕψος λαμβανουσῶν, αἱ δὲ ἐπίλοιποι τεσσάρων πηχῶν καὶ δύο παλαιστῶν τὸ ὕψος ἐγίνοντο. Ὁμοίως δὲ καὶ ἐπὶ τοῦ ἐλάττονος πύργου ἡ διαίρεσις τῶν στεγῶν τὸν αὐτὸν λόγον ἐλάμβανεν· ἐβύρσουν δὲ αὐτὰς ἀργαῖς βύρσαις.[3]

Hanc magnitudinem turris faciebat tabulatorum XX, cum haberent singula tabulata circumitionem cubitorum ternum; tegebat autem coriis crudis, ut ab omni plaga essent tutæ.

The translator has left out the whole middle part: *εἰς τὴν ἐκβοήθησιν . . . λόγον ἐλάμβανεν.*

Τῆς δὲ χελώνης τῆς τὸν κριὸν φερούσης ἡ p. 13. *ἐργασία ἦν ἡ αὐτὴ μικρῆς τε καὶ μεγάλης. Ἡ δὲ μεγίστη ἐλάμβανε τὸ διάστημα τοῦ πλάτους πήχεις λ, τὸ δὲ μῆκος πήχεις μ, τὸ δὲ ὕψος χωρὶς τῆς ἀετώσεως τῆς ἐφισταμένης ὕστερον πήχεις ιγϲ, τῆς δὲ ἀετώσεως αὐτῆς τὸ ὕψος ἀπὸ τοῦ καταστρώματος ἐπὶ ὀξύτατον πήχεις ις.*[4]

6. Testudinis arietariæ comparatio eadem ratione perficiebatur. Habuerat autem intervallum cubitorum XXX, altitudinem præter fastigium XVI, fastigii autem altitudo ab strato ad summum cubita VII.

The translator has misunderstood the original. He says that the tortoise is made *eadem*

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[1] He says that the smallest tower must be 60 cubits in height and 17 in width. The contraction at the top should be equal to one fifth of the width of the base. The posts of the tower should be 8 palms thick at the base and 17 fingers at the top. He builds a tower of these dimensions with 10 stories, each of them being surrounded by a row of columns.

[2] The largest of these towers is 120 cubits high and 28½ cubits wide; its contraction at the top is also one fifth. The thickness of the posts is one foot at the bottom; their section is square and decreases regularly towards the top, where its sides measure about 6 fingers.

[3] A tower with these proportions has twenty stories, each of which has a balcony three cubits broad running round it in order to facilitate help in case of fire. The first story is to be 7½ cubits high, the second 5, and the same height is to be given to each story up to the fifth, after which the remaining stories are only to be 4 cubits and 2 palms high. As for the small tower, the same proportions are to be observed with regard to the stories. These towers were covered with untanned ox-hides.

[4] As for the tortoise carrying the ram, its structure is the same whether it be large or small. The largest one is 30 cubits broad and 40 cubits long, with a height of 18½ cubits besides the gable, which is placed on it afterwards; the height of the gable in question is 16 cubits from ceiling to apex.

ratione, in the same manner. As what? Nothing is found previously to which these words might refer. The original says: "The tortoise is made in the same way whether it be large or small." Also in the following passages we find great negligence. The height and length are indicated, but the breadth is left out; nor are the numbers correct.

Ὑπερέβαλλε δὲ τὴν μέσην στέγην ὁ ἀετὸς
τοὐλάχιστον πήχεις δύο, παρακαταβαίνων τὴν
ἐπιστέγην ἕως τῶν ἐπ' αὐτῷ δοκῶν, ὅπως ᾖ
περίδρομος ἔνκυκλος. Ἐξῆρε δ' ἐκ μέσης τῆς
στέγης πυργίον τρίστεγον, καὶ εἰς μὲν τὰς ἄνω
στέγας ἐτίθει καταπάλτας, εἰς δὲ τὴν κάτω
ὕδατος παράθεσιν ἐποιεῖτο. Ἐγίνοντο δὲ αὐτῇ
τῇ χελώνῃ ὀρθοστάται κύκλῳ περίδρομον ἐχούσῃ.
p. 14. Ἵσταται δὲ καὶ κριοδόχην ἐν αὐτῇ, ἐφ' ᾗ τὸν
κύλινδρον ἐτίθει, δι' οὗ προωθούμενος ὁ κριὸς δι'
ἀντισπάστων ἐνήργει τὴν χρείαν. Ἐβύρσουν
δὲ καὶ ταύτην ὁμοίως τοῖς πύργοις.[1]

Exibat autem in altum et supra medium tectum fastigium non minus cubita duo, et supra extollebatur turricula quattuor tabulatorum, in qua tabulato summo statuebantur scorpiones et catapultæ, inferioribus congerebatur aquæ magna multitudo ad extinguendum, si qua vis ignis immitteretur. Constituebatur autem in ea arietaria machina, quæ Græce dicitur κριοδόκη, in qua collocabatur torus perfectus in torno, in quo insuper constitutus aries rudentium ductionibus et reductionibus efficiebat magnos operis effectus. Tegebatur autem is coriis crudis quemadmodum turris.

The translator has left out two sentences. He gives four stories to the tower instead of three, and while the original has catapults in the two upper stories and water in the lower one, Vitruvius has catapults in the one uppermost story and water in the others. In the last sentence is a remarkable misunderstanding. Athenæus says that the ram-holder should be covered with hides; Vitruvius refers this to the ram (*is*).

Τὸ δὲ τρύπανον χελώνην μὲν τὴν αὐτὴν [ἔχει]
τῷ κριῷ, λαμβάνει δὲ καὶ πᾶσαν τὴν κατασκευὴν
ὁμοίως ἔχουσαν. Τίθησι δὲ ἐπὶ τῆς κρηπῖδος
σύριγγα παραπλησίαν τῇ ἐν τοῖς εὐθυτόνοις
γινομένῃ καταπάλταις καὶ πλάγιον ὄνισκον
ὁμοίως ἐκείνοις ἔχουσαν. Ἐκ δὲ τοῦ ἄλλου
μέρους αὐτῆς ἀπὸ τοῦ ἄκρου τροχιλέας ἐμβάλλει
δύο, δι' ὧν προωθεῖ τὴν ἐπιτιθεμένην ἐν αὐτῇ
κεραίαν, καὶ ἐπὶ τοῦ καταστρώματος δὲ τοῦ ἐν
τῷ συριγγίῳ πυκνοὺς τίθησι κυλίνδρους, ἵνα
εὐκίνητος ὑπάρχῃ, καὶ οὕτως βάλλει τὴν κεραίαν,
ἐν ᾗ κριοκοπεῖ, ἐφελκόμενος αὐτὴν ἐκ τοῦ κάτω
p. 15. ὀνίσκου κειμένου. Βυρσοῦται κύκλῳ σὺν ταῖς
ἀψῖσι τὴν σύριγγα, ἵνα σκεπάζηται εἰς αὐτὴν ἡ
κέραια ἔσωθεν.[2]

7. De terebra has explicuit scriptis rationes. Ipsam machinam uti testudinem in medio habentem collocatum in orthostatis canalem, quemadmodum in catapultis aut ballistis fieri solet, longitudine cubitorum L, altitudine cubiti, in quo constituebatur transversa sucula, in capite autem dextra ac sinistra trocleæ duæ, per quas movebatur quod inerat in eo canali capite ferrato tignum. Sub eo autem in ipso canali inclusi tori crebri celeriores et vehementiores efficiebant eius motus. Supra autem id tignum, quod inibi erat, arcus erigebantur ad canalem crebriter, uti sustinerent corium crudum, quo ea machina erat involuta.

The translator follows the original tolerably; still he does not build the groove or canal on a firm foundation but on posts, and he adds measures of height and length of his own. He omits the sentence *οὔτως . . . κειμένου.*

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[1] The gable protrudes at least two cubits beyond the middle floor, and its rafters are so long that they make the roof come down so as to cover it and to allow walking round it. On the middle floor is erected a tower, three stories high, the upper two of which contain catapults, the bottom one a provision of water. The tortoise is surrounded by pillars, and has a platform all round. In it is raised the ram-holder (*kriodoche*) on which the cylinder is placed, in which the ram is propelled and has its effect. The ram-holder, too, is covered with hides as well as the towers.

[2] The borer stands on a tortoise like that of the ram, and it is quite similarly constructed. On its base is applied a groove similar to the one seen in the euthotonic catapults, and likewise provided with a transverse cylinder. At the opposite end two pulleys serve to launch the beam which is placed above the groove, on the bottom of which are applied numerous rollers in order to facilitate the movement of the beam, which is propelled and repelled by means of the cylinder underneath. The arches above the groove are covered with skin so as to protect the beam below.

Hereafter Athenæus has a passage which has no connection with the text and evidently is taken from another place. Vitruvius is right in omitting it. Then follows:

> *Τὸν δὲ κόρακα οὔ φημι εἶναι ἄξιον κατασκευῆς.*[1]

> 8. De corace nihil putavit scribendum, quod animadverteret eam machinam nullam habere virtutem.

Vitruvius translates, not *φημί*, "I say," but *φησί*, "he says," thus making Diades the subject. But he who invented this machine is not likely to have himself declared it to be a bad one; it is Athenæus who disapproves of it, and therefore omits its description.

> *Τὴν δὲ ἐπιβάθραν ὃν τρόπον δεῖ γενέσθαι προειπὼν ἐν ἀρχῇ δηλώσειν οὐδὲν διεσαφήνισεν, οὐδ' ὑπὲρ τῶν κατὰ θάλατταν διὰ νεῶν προσαγομένων ἔργων δεδήλωται· ἀλλὰ καὶ ταῦτα παρεῖται, καίτοι σφόδρα ἐπαγγελτικῶς καὶ μεγάλως ποιησαμένου τοὺς λόγους. Ἡμεῖς δ' ἐγράψαμεν πρῶτον χελώνης χωστρίδος κατασκευὴν, εἶτα τῶν ἄλλων μηχανημάτων.*[2]

> De accessu, quæ *ἐπιβάθρα* Græce dicitur, et de marinis machinationibus, quas per navim aditus habere posse scripsit, tantum pollicitum esse vehementer animadverti neque rationes earum eum explicavisse. Quæ sunt ab Diade de machinis scripta quibus sint comparationibus, exposui. Nunc quemadmodum a præceptoribus accepi et utilia mihi videntur, exponam.

That Athenæus criticises Diades in this way we can understand; but that Vitruvius also translates this passage not only proves that he likes pluming himself with borrowed feathers, but it must also convince the reader of the fact that he has simply translated Athenæus and not merely drawn his information from the same source.

Now Athenæus leaves Diades, and so, of course, does Vitruvius; but he does not leave Athenæus. He follows him as hitherto, with the only difference that henceforth he speaks of feet instead of cubits, counting a foot as ⅔ of a cubit. But his calculations are frequently incorrect, unless we should attribute these faults to the copyist of the manuscript.

> p. 16. *Τοῦτο τὸ κατασκεύασμά φησι Φίλων ὁ Ἀθηναῖος χρήσιμον εἶναι πρός τε τὰς γινομένας εἰς τὴν προσαγωγὴν τῶν μηχανημάτων παρόδους καὶ τὰς παρεκτάσεις τῶν σταδίων καὶ τὰς συγχώσεις τῶν τάφρων, καὶ ἐάν τινα ἄλλον τόπον δέῃ χῶσαι· χρήσιμον δὲ καὶ πρὸς τὰς ἐφεδρίας τοῦτο γίνεται.*[3]

> 20 (14). Testudo, quæ ad congestionem fossarum paratur, e qua etiam accessus ad murum potest haberi, sic erit facienda.

Vitruvius has left out the last part.

> *Πήγνυται δὲ αὐτὴ εἰς ἐσχάριον τετράγωνον ἔχον τὴν πλευρὰν ἑκάστην πηχῶν ιδ̅· ἔχει δὲ καὶ διαπήγματα τέσσαρα καὶ περιπήγματα δύο, τὰ μὲν πάχη ἔχοντα δέκα δάκτυλα, τὰ δὲ πλάτη*

> Basis compingatur, quæ Græce *ἐσχάρα* dicitur, quadrata habens quoque versus latera singula pedum XXV et transversaria quattuor. Hæc autem contineantur ab

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[1] As for the *Raven*, I do not consider it worth while to construct.

[2] Touching the *Flying Bridge* (*epibathra*), Diades, though having promised in the beginning of his book to show in what manner it was to be constructed, says no more about it; neither has he given any explanation of the engines he has composed to be used on ships. All these points are left out, though they have been formally and pompously announced. We now begin by describing the *Sappers' Tortoise*, and afterwards the other engines.

[3] Philo, the Athenian, says that this structure is useful in preparing approaches either for the purpose of advancing the engines, for extending the porticos, for filling up ditches, or for raising the ground wherever it is wanted. It is also useful in establishing posts of observation.

*τριπάλαιστα. Διάπηγμα ἕκαστον ἀπεχέτω δύο
πήχεις καὶ παλαιστὴν ἕνα. Λαμβάνει δὲ
ἁμαξίποδας ἑκάστη χώρα τεσσάρων τῶν ἐν ταῖς
γωνίαις, ἐν οἷς στρέφονται οἱ τῶν τροχῶν
ἄξονες ἀποκλειόμενοι σπάθαις σιδηραῖς, ἵνα,
ὅταν δέῃ παροδοποιεῖν προάγοντας (τουτέστιν
εἰς τοὔμπροσθεν πλατὺν τόπον ποιεῖν ἢ καὶ
ὁμαλὸν πρὸς τὸ πολεμῆσαι ἢ καὶ παρατιθέναι
τινὰ μηχανήματα) ἐξῇ ἐκσπάσαντα τοὺς τροχοὺς
μετὰ τὸ ἀποκλεῖσαι τοὺς ἄξονας. Οἱ δὲ τροχοὶ*
p. 17. *γίνονται τέσσαρες τὴν μὲν διάμετρον τριπήχεις,
τὸ δὲ πάχος ποδιαῖοι, δεδεμένοι σιδηραῖς λεπίσι
ψυχρηλάταις.*[1]

alteris duobus crassis FS, latis S. Distent autem transversaria inter se circiter pede et S, supponanturque in singulis intervallis eorum arbusculæ, quæ Græce ἁμαξόποδες dicuntur, in quibus versantur rotarum axes conclusi lamnis ferreis; easque arbusculæ ita sint temperatæ, ut habeant cardines et foramina, quo vectes traiecti versationes earum expediant, uti ante et post et ad dextrum seu sinistrum latus sive oblique ad angulos opus fuerit, ad id per arbusculas versatas progredi possit.

About the bearings (*hamaxipodes* or *arbusculæ*) Vitruvius adds that they ought to be constructed so as to be able to swing and the machine to be moved forward and backward. This is borrowed from the following (Athen. p. 26 Wescher=Vitr. X, 21, 7). He has left out the description of the wheels at the end of the paragraph. The numbers are confused.

Ἐπιζεύγνυται δὲ ἐπὶ τὸ ἐσχάριον ξύλα δύο ἑκατέρας πλευρᾶς ὑπερέχοντα καθ' ἑκάτερον μέρος τοῦ μήκους πήχεις δ̄· περὶ δὲ τὰς ὑπεροχὰς αὐτῶν περιπήγνυται ἄλλα δύο ξύλα ὑπερέχοντα ἐκ μὲν τοῦ πρόσθεν μέρους πήχεις η̄, ἐκ δὲ τοῦ ὀπίσω πήχεις δ̄· πάχη δὲ ἕκαστα λαμβάνει αὐτῶν καὶ πλάτη τὰ αὐτὰ τῷ ἐσχαρίῳ.[2]

2. Conlocentur autem insuper basim tigna duo in utramque partem proiecta pedes senos, quorum circa proiecturas figantur altera proiecta duo tigna ante frontes pedes VII, crassa et lata uti in basi sunt scripta.

The translator is careless. The beams are only said to jut out in front, but not at the back, and the measures are incorrect.

*Αὐτῷ τε ἐσπήγνυνται τῷ ἐσχαρίῳ ἐπὶ τὸ
πλινθίον αὐτοῦ κίονες ἑπταπήχεις διαλείποντες
ἀπ' ἀλλήλων ἕκαστος πῆχυν ἕνα· κατακλείει δὲ
αὐτοὺς ἐπάνω κύκλῳ πάντας ἐπιστύλιον· καὶ ἀπ'
αὐτοῦ συστάται ἵστανται εἰς ἀλλήλους ἐξερείδον-
τες τὴν ἀνάστασιν τοῦ ὕψους ποιοῦντες πήχεις
η̄· ἐπὶ δὲ τῶν συστατῶν ἐπιζεύγνυται δοκός.
Οἱ δὲ συστάται ἀντηρίσι καὶ πλευμώμασι
διαλαμβάνονται, καὶ φράττονται αἱ στέγαι
πᾶσαι σανιδώμασι μάλιστα μὲν φοινικινοῖς, εἰ
δὲ μή, τῶν ἄλλων ὅσα εὔτονά ἐστι ξύλα πλὴν
κεδρίνων, πευκίνων καὶ κληθρίνων· ταῦτα γὰρ*
p. 18. *καὶ ἔκπυρά ἐστι καὶ εὔκλαστα. Καταλαμ-
βάνεται δὲ ἄνωθεν τὸ σανίδωμα γέρροις πεπλεγ-*

Insuper hanc compactionem erigantur postes compactiles præter cardines pedum VIIII, crassitudine quoquo versus palmipedales, intervalla habentes inter se sesquipedis. Ei concludantur superne intercardinatis trabibus. Supra trabes conlocentur capreoli cardinibus alius in alium conclusi, in altitudine excitati pedes VIIII. Supra capreolos conlocetur quadratum tignum,
3. quo capreoli coniungantur. Ipsi autem laterariis circa fixis contineantur teganturque tabulis maxime prininis, si non, ex cetera materia quæ maxime potest habere virtutem, præter pinum aut alnum; hæc

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[1] It is placed on a square frame, each side of which measures fourteen cubits; it has four transverse beams, on which two longitudinal ones are placed crosswise; all these pieces must be ten fingers thick and three palms broad. The intervals between the transverse beams must be two cubits and a palm. In each of the four corner spaces are applied bearings (*hamaxipodes*), inside which the axles of the wheels revolve; they are enclosed in iron bands, so that if, for the purpose of approaching a fortress, a level plane has to be worked, either to fight upon or to place engines on, this may be done after removing the wheels, the axles of which have been taken out previously. The wheels are four in number; they have a diameter of three cubits, are one foot broad and enclosed in rims of cold-beaten iron.

[2] On the fundamental framework are fixed two pieces of wood which stand out beyond the frame four cubits; across the protruding ends of these pieces are applied two other beams which jut out eight cubits in front and four at the back. These beams are equal in thickness to those of the frame.

μένοις λεπτοῖς καὶ πυκνοῖς ὡς ἔνι προσφάτοις. Ἐπὶ δὲ τούτοις καταλαμβάνονται βύρσαις ῥεραμμέναις ὁμοίως ταῖς τύλαις καὶ σάττεται εἰς αὐτὰς μάλιστα μὲν ἕλεια ἢ τὸ καλούμενον θαλασσόπρασον ἢ ἄχυρα ὄξει βεβρεγμένα· ταῦτα δέ εἰσι χρήσιμα πρός τε τὰς τῶν λιθοβόλων πληγὰς καὶ πρὸς τοὺς ἐμπυρισμούς.[1]

enim sunt fragilia et faciliter recipiunt ignem. Circum tabulata conlocentur crates ex tenuibus virgis creberrime textæ, maximeque recentibus percrudis coriis duplicibus consutis fartis alga aut paleis in aceto maceratis circa tegatur machina tota. Ita ab his reicientur plagæ ballistarum et impetus incendiorum.

The translation is faithful on the whole, except the measures. Athenæus prefers palm-wood for the boarding, which seems to point to an Eastern origin; Vitruvius, the Italian, prefers that of the Italian oak.

Ἄλλη δέ τις ἐστὶ χωστρὶς χελώνη, τὰ μὲν ἄλλα παραπλησίως ταύτῃ πεπονημένη καὶ κατακλείσεις τὰς αὐτὰς ἔχουσα, πλὴν τοὺς συγκύπτας οὐκ ἔχει, ἀλλὰ κύκλῳ ἐπάνω τῶν κιόνων καὶ τῶν ἐπιστυλίων θωράκιον καὶ ἔπαλξιν ἐκ σανίδων καὶ γέρρων, καὶ ἐκὶ τῶν σελμάτων σανίσιν ἰσχυραῖς περιβέβληται. Κατείληπται δὲ καὶ πηλῷ τετριχωμένῳ πάχος ἔχοντι ὥστε τὸ πῦρ μὴ ἐνοχλεῖν. Καὶ ἔστιν αὕτη χρησίμη οὐ μόνον εἰς χῶσιν, ἀλλὰ καὶ εἰς τὰς ἐφέδρας· οἱ γὰρ στρατιῶται ἐμβαίνοντες εἰς αὐτὴν προσάγουσι πρὸς τὸ τεῖχος ὥστε ἐντὸς βέλους γενόμενοι
p. 19. *ἐφεδρεύειν. Αὕτη δὲ γένοιτ' ἂν ὀκτάτροχος ἡ χελώνη· ἀλλὰ τοιαῦτα μηχανήματα ἔξεστι μετασκευάζειν τῷ τεχνίτῃ ἐμβλέποντι εἰς τοὺς τόπους τῶν προσαγωγῶν.*[2]

21 (15). Est autem et aliud genus testudinis, quod reliqua omnia habet quemadmodum quæ supra scripta sunt, præter capreolos, sed habet circa pluteum et pinnas ex tabulis et superne subgrundas proclinatas supra, quæ tabulis et coriis firmiter fixis continentur. Insuper vero argilla cum capillo subacta ad eam crassitudinem inducatur, ut ignis omnino non possit ei machinæ nocere. Possunt autem, si opus fuerit, eæ machinæ ex VIII rotis esse, si ad loci naturam ita opus fuerit temperare.

Literally translated, only with the omission of the words *Καὶ ἔστιν αὕτη . . . ἐφεδρεύειν.*

Τὸ δὲ τῆς ὀρυκτρίδος χελώνης γένος τὰ μὲν ἄλλα παραπλησίως τοῖς πρότερον ᾠκονόμηται, τὴν δὲ
p. 20. *ἔμπροσθεν ὀρθὴν ἔχει προσαγωγήν, ὅπως προσελθοῦσα πρὸς τὸ τεῖχος ἀπαρτίσῃ αὐτῷ καὶ μὴ παρεισπίπτῃ ἀπὸ τοῦ τείχους τὰ ἀφιέμενα βέλη, ἀλλ' ἀσφαλῶς οἱ ὑπορύττοντες ἐν αὐτῇ ὄντες ἐργάζωνται.*[3]

Quæ autem testudines ad fodiendum comparantur — *ὀρυκτρίδες* Græce dicuntur — cetera omnia habent uti supra scriptum est, frontes vero earum fiunt quemadmodum anguli trigoniorum, uti, a muro tela cum in eas mittantur, non planis frontibus excipiant plagas sed ab lateribus labentes, sine periculoque fodientes qui intus sunt tueantur.

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[1] On the base itself and into its frame are erected pillars, seven cubits high, at one cubit's distance from each other. An architrave joins them all at the top. On this architrave rafters are placed so as to lean against each other, the total height becoming eight cubits; they are joined at the top by a ridge-pole and secured by supports and inferior timbers, for which palm-wood is preferred, or for want of it, other wood of the most resistent kinds, except the cedar, the fir and the alder, which are too combustible and too fragile. The roof is covered outside by wicker-mats, as fine, tight and fresh as possible, above which are attached untanned hides, sewn like mattresses and stuffed preferably with marshy plants, seaweeds or straw mashed in vinegar. These arrangements are as useful against the damages of ballista (*lithoboles*) as against fire.

[2] There exists another *Sappers' Tortoise* constructed on the same plan as the above, and covered in a similar way, except that it has no rafters, but all round above the pillars and architraves is applied a thorax and a parapet made of boards and wicker-work. The covering consists of very solid boards which are plastered with mud mixed with hair, thickly enough to protect it from fire. This tortoise is useful not only for sapping, but also for lying in wait, for the soldiers stepping into it draw it towards the wall so as to be able to observe the enemy though being within reach of his projectiles. This tortoise is supplied with eight wheels, but the engineer can introduce such alterations as the nature of the ground may require.

[3] The *Miners' Tortoise* is very like the preceding one, save that it is moved straight forward, so that

Instead of *ὀρυκτρίδες* the manuscripts of Vitruvius have "origines;" the editors have put *ὄρυγες*, a form not known in this sense. The translators' attempt to explain the way it is used by *anguli trigoniorum* is not at all successful.

p. 21. Τῆς δὲ ὑπὸ Ἡγήτορος τοῦ Βυζαντίου ηὑρημένης
χελώνης γίνεται τὸ μὲν μῆκος τοῦ ἐσχαρίου
πηχῶν μβ, πλάτος δὲ κη. Τὰ δὲ σκέλη τὰ ἐπὶ
τοῦ ἐσχαρίου πηγνύμενα τέσσαρά τε συντίθεται
καὶ ἕκαστον ἐκ δύο ξύλων συνημμένον τὸ μῆκος
μὲν ἐχόντων πήχεις κδ, τὸ δὲ πάχος ε
παλαιστάς, τὸ δὲ πλάτος πηχναῖα. Τροχοὶ δὲ
γίνονται ἐν αὐτῇ ὀκτώ, δι' ὧν ἀνάγεται τὸ
σύμπαν ἔργον. Τὸ μὲν ὕψος αὐτῶν εἰς πήχεις
δϛ, τὸ δὲ πάχος πήχεις β· συμβάλλονται κατὰ
p. 22. πλάτος καὶ πάχος ἀμφαλλὰξ καὶ δεσμεύονται
λεπίσι ψυχρηλάταις· στρέφονται δὲ ἐν ἀμαξίποσιν.[1]

2. Non mihi etiam videtur esse alienum de
testudine, quam Hegetor Byzantius fecit,
quibus rationibus sit facta exponere.
Fuerat enim eius baseos longitudo pedum
LX, latitudo XIII. Arrectaria, quæ supra
compactionem erant quattuor conlocata ex
binis tignis fuerant compacta, in altitudinibus
singula pedum XXXVI, crassitudine
palmipedali, latitudine sesquipedali. Basis
eius habuerat rotas VIII, quibus agebatur.
Fuerat autem earum altitudo pedum VI S÷
crassitudo pedum III; ita fabricata triplici
materia alternis se contra subscudibus
inter se coagmentata lamnisque ferreis ex
3. frigido ductis alligata. Eæ in arbusculis,
sive amaxopodes dicuntur habuerant versationes.

The translator is faithful on the whole, except the measures. Here, too, Vitruvius tries to explain the notice of Athenæus about the composition of the wheels; if correctly or not, we cannot say.

Κίονες δὲ πήγνυνται ἐπὶ τοῦ ἐσχαριου δωδεκαπήχεις πλάτος μὲν ἔχοντες παλαιστὰς γ, πάχος δὲ δέκα δακτύλους· ἀπέχει δὲ ἄλλος ἀπ' ἄλλου κίων παλαιστὰς ζ, καὶ ἐπιζεύγνυνται ἐπ' αὐτῶν ἐπιστύλια κύκλῳ πλάτος ἔχοντα παλαιστὰς δ, πάχος δὲ γ. Ἐπὶ δὲ τῶν ἐπιστυλίων πήγνυνται συγκύπται τὸ ὕψος ἐξαίροντες πήχεις η, καὶ ἐπ' αὐτῶν δοκὸς ἐμπήγνυται πλαγία, εἰς ἣν πᾶσαι αἱ κορυφαὶ τῶν συγκυπτῶν πήγνυνται. Καὶ γίνονται δύο πλευραὶ κεκλιμέναι, καὶ λοιπὸν τὸ πᾶν ἔργον σανιδοῦται καὶ σκεπάζεται παραπλησίως ταῖς χωστρίσι χελώναις. Ἔχει δὲ καὶ μέσην στέγην ἐπὶ τῶν στύλων ἀναπαυομένην, ὅπως ἡ βελοστασία ἐπ' αὐτῆς εἴη.[2]

Item supra transtrorum planitiem, quæ
supra basim fuerat, postes erant erecti
pedes XVIII, latitudinis S÷, crassitudinis
FZ, distantes inter se IS÷; supra eos
trabes circumclusæ continebant totam compactionem
latæ pede I÷, crassæ S÷;
supra eam capreoli extollebantur altitudine
pedum XII; supra capreolos tignum conlocatum
coniungebat capreolorum compactiones.
Item fixa habuerant lateraria in
transverso, quibus insuper contabulatio cir-
4. cumdata contegebat inferiora. Habuerat
autem mediam contabulationem supra
trabeculas, ubi scorpiones et catapultæ
conlocabantur.

I have corrected the measures of Vitruvius, because the faults seemed to belong to the copyist.

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when drawn close to the wall it may fit tightly to it, not allowing the missiles thrown from above to get in between, and thus leaving the miners within to work in safety.

[1] The tortoise invented by Hegetor of Byzantium has a fundament of 42 cubits long, and 28 cubits broad. The posts planted into it are four in number, and each consists of two pieces of wood joined together, 24 cubits in length, five palms thick, and one cubit broad. The whole machine moves on eight wheels, their height being 4½ cubits and their thickness 2 cubits. They are composed of beams placed alternately after the breadth and the thickness, and bound by cold-forged tyres. They move in bearings.

[2] On the fundament there are planted pillars twelve cubits high, three palms broad, and ten fingers thick. The distance between the pillars is seven palms. An architrave is attached to them all round, four palms broad and three palms thick. On the architraves are inserted rafters rising eight cubits in height. To the top of them is fitted a ridge-pole, into which are driven the tops of all the rafters. Thus a slope is formed on

*῞Ισταναι δὲ ὀπίσω τῆς κριοδόχης σκέλη δύο
p. 23. συμβεβλημένα ὄρθια ἐν μέσῳ τῆς χελώνης
ἔχοντα κατὰ τὸ μῆκος τριάκοντα πήχεις, τὸ δὲ
πάχος αὐτῶν πηχυαῖον, τὸ δὲ πλάτος τριπαλαιστιαῖον.
'Εφαρμόζεται δὲ ἐπ' αὐτῶν περικέφαλον
καὶ μέσον ἄλλο διὰ τῶν σκελῶν
διάπηγμα, καὶ ἀναμέσον τοῦ τε περικεφάλου καὶ
τοῦ διαπήγματος πήγνυται ξύλον ὄρθιον, καὶ
ἐφ' ἑκατέρου μέρους τοῦ ξύλου τοῦ παγέντος καὶ
τῶν σκελῶν ἐμβάλλονται ὀνίσκοι τετορνευμένοι,
ἐξ ὧν τὰ ὅπλα ἐξήρτηται τὰ ἀνέχοντα τὸν κριόν.
'Επὶ δὲ τοῦ περικεφάλου τῆς κριοδόχης πήγνυται
θωράκιον ὥστε ἐν αὐτῇ ἀσφαλέστατα δύνασθαι
ἑστάναι τοὺς ἐφοπτεύοντας τὰ ἀποστελλόμενα
ἐκ τῶν ἐναντίων πρὸς τὸν κριόν.*[1]

Erigebantur et arrectaria duo compacta
pedum XXXV crassitudine sesquipedali,
latitudine pedum II, coniuncta capitibus
transversario cardinato tigno et altero
mediano inter duos scapos cardinato et
lamnis ferreis religato. Quo insuper conlocata
erat alternis materies inter scapos
et transversaria traiecta cheloniis et anconibus
firmiter inclusa. In ea materia fuerunt
ex torno facti axiculi duo, e quibus funes
5. alligati retinebant arietem. Supra caput
eorum, qui continebant arietem, conlocatum
erat pluteum turriculæ similitudine
ornatum, uti sine periculo duo milites tuto
stantes prospicere possent et renuntiare
quas res adversarii conarentur.

The middle part of the text of Vitruvius is incomprehensible to me, so that here I cannot make any comparison with the original. In the last sentence he has made a few additions which are quite unimportant: namely, that the breastwork is to be fitted up like a tower, and that the watchmen are to be two in number.

Τοῦ δὲ κριοῦ τὸ σύμπαν γίνεται μῆκος πήχεις ρκ, ἐκ δὲ πτέρνης πάχος μὲν ποδῶν $\overline{\beta}$, πλάτος δὲ πέντε παλαιστῶν· εἰς ἄκρον δὲ συνῆκται αὐτοῦ τὸ μὲν πάχος ποδιαῖον, τὸ δὲ πλάτος τριπαλαιστιαῖον. ῎Εχει δὲ καὶ στόμα σιδηροῦν ὅμοιον ἐμβόλῳ προμήκει.[2]

Aries autem eius habuerat longitudinem
pedum CIV, latitudine in imo palmipedali,
crassitudine pedali, contractu a capite in
6. latitudine pedis, crassitudine S-̣ Is autem
aries habuerat de ferro duro rostrum ita uti
naves longæ solent habere.

The next piece not being sufficiently clear either in Athenæus or in Vitruvius, I prefer to omit it. Then follows:

*Βυρσοῦται δὲ κύκλῳ, ὅταν κατελιχθῇ, βύρσαις
ἀργαῖς. Τὰ δὲ ὅπλα, ἀποτεταμένα ἐκ τῶν
ὀνίσκων τῶν ἐκ τῆς κριοδόχης καὶ ἀνέχοντα τὸν
p. 25. κριὸν, ἔχει τὰς ἀρχὰς ἁλύσεσι σιδηραῖς τετραπλαῖς
πεπλεγμένας, καὶ περιβεβύρσωνται αἱ
ἁλύσεις πρὸς τὸ μὴ ὁρᾶσθαι.*[3]

Insuper coriis crudis totus aries erat involutus. Ex quibus autem funibus pendebat, eorum capita fuerunt ex ferro factæ quadruplices catenæ, et ipsæ coriis crudis erant involutæ.

p. 26. *Καθαιρεῖ δὲ ἀπὸ ἑβδομηκονταπήχους ὕψους, καὶ
εἰς τὰ πλάγια παρασύρει ἐπὶ πήχεις ἑβδομή-*

Erigebatur autem machina in altitudinem ad disiciendum murum circiter pedes C,

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each side, after which the structure is provided with boards and covered in the same way as the *Sappers' Tortoise*. It has also a middle roof resting on pillars on which the battery can be placed.

[1] Behind the ram-holder in the centre of the tortoise are placed two joint standards, thirty cubits long, one cubit thick and three palms broad. On the top of them is laid a headpiece, and they are joined in the middle by a crossbeam. Between the headpiece and the crossbeam is fixed a perpendicular beam, on either side of which (between it and the standards) are fitted revolving windlasses, from which are suspended the ropes which hold up the ram. On the headpiece of the ram-holder a thorax is constructed, which serves to protect those who are to watch the missiles hurled towards the ram.

[2] The total length of the ram is 120 cubits. The thickness at the hind-end is two feet and its breadth five palms; at its head the thickness contracts to one foot and its breadth to three palms. It has an iron beak similar to the beak of a ship.

[3] The battering ram is covered all over first with cordage, then with raw hides. The ropes which, being stretched from the windlasses on the ram-holder, hold up the ram, have fourfold iron chains at the upper end. These chains are also covered with hides so as to be invisible.

κοντα· οἰακίζεται δὲ ὑπὸ ἀνδρῶν ρ̅, ἔχουσα τὸ σύμπαν βάρος τάλαντα τετρακισχίλια.[1]

item a latere dextra et sinistra procurrendo præstringebat non minus pedes C. Gubernabant eam homines C habentem pondus talentum quattuor milium, quod fit CCCC$\overline{\mathrm{LXXX}}$ pondo.

Vitruvius renders 4000 talents by 480,000 pounds, which agrees well with his subsequent statement that a stone weighing three talents is one of 360 pounds. According to him a talent has 120 pounds.

Here the continuous translation of Athenæus is at an end. Henceforth Vitruvius works more at his ease. In chap. 22 (16) he thinks he has said enough about the different catapults, tortoises and towers; he will not write about means of defence; they must be arranged according to circumstances. As an instance he quotes a story from the siege of Rhodes by Demetrius Poliorketes, when the defenders succeeded in rendering his famous Helepolis ineffective. Athenæus mentions this machine in immediate connection with the above-quoted lines, p. 27: ‘Η *δὲ ὑπὸ* ’Ε*πιμάχου τοῦ* ’Α*θηναίου γενομένη ἑλέπολις, ἣν* Δ*ημήτριος ὁ* ‘Ρ*οδίους πολιορκῶν προσήγαγε τοῖς τείχεσιν αὐτῶν, ἔστι τοιάδε.* Τ*ὸ μὲν ὕψος λαμβάνει πήχεις* ϙ̅ *τὸ δὲ πλάτος πήχεις* μ̅ *· γίνεται δὲ τῷ σχήματι πυργοειδής· ὑπομένει δὲ πληγὴν ὡς τριαταλάντου λίθου.*[2] Vitruvius, chap. 22 (16), 4: “Interea rex Demetrius, qui propter animi pertinaciam Poliorcetes est appellatus, contra Rhodum bellum comparando Epimachum Atheniensem nobilem architectum secum adduxit. Is autem comparavit helepolim sumptibus immanibus industria laboreque summo, cuius altitudo fuerat pedum CXXV, latitudo pedum LX. Eam ciliciis et coriis crudis confirmavit, ut posset pati plagam lapidis ballista immissi pondo CCCLX; ipsa autem machina fuerat milia pondo CCCLX.” We see the correspondence; the additions are of no value.

Athenæus continues by saying that he will not speak of *σαμβῦκαι*, the engines constructed on ships, as they are generally known, and if not managed with great skill, dangerous. This appeared at the siege of Chios. They had been made considerably higher than the walls of the town, so that when they were to be used, the men dared not jump down on the wall from such a height, and the machine could not be lowered without upsetting the ships. When subsequently the besiegers put fire to the machine, the whole crew died in the flames. Vitruvius mentions this lower down, in § 9: “Non minus Chio cum supra naves sambucarum machinas hostes comparavissent, noctu Chii terram harenam lapides progesserunt in mare ante murum. Ita illi postero die cum accedere voluissent, naves supra aggerationem, quæ fuerat, sub aqua sederunt nec ad murum accedere nec retrorsus se recipere potuerunt, sed ibi malleolis confixæ incendio sunt conflagratæ.”[3]

Vitruvius does not seem to have understood Athenæus. His description reminds us of the story told above about the defence of the Rhodii against the *helepolis* of Demetrius. Compared with the reports of Diodorus and Plutarch this tale proves to be as untrustworthy as the afore-mentioned history of the siege of Massilia.

Athenæus relates the story in order to show that a mechanician ought to have some knowledge of optics. "A similar thing," he continues, "happened to Callistratus, who writes about mechanics, when he had to transport stones to the temple in Ephesus. He had constructed a triangular machine, the drawing of which was much admired, but which proved unable to move the stones. On this occasion he makes the remark that small models sometimes deceive you, as they cannot always be constructed in full size, while, on the other hand, some objects cannot be represented in small models, but must be executed at once in the proper size :—*Οὐ γὰρ συνεῖδεν ὅτι ἔνια ἐπὶ τῶν μικρῶν παραδειγμάτων τὴν φαντασίαν ποιοῦσιν· οὐ γὰρ γίνονται εἰς αὔξησιν τὰ τοιαῦτα· πάλιν δὲ ἐπ' ἐνίων μικρὰ παραδείγματα οὐ δύνανται γενέσθαι, ἀλλὰ τὰ ἐνεργοῦντα εὐθὺς κατασκευάζονται.*[1] This remark is so much to the taste of Vitruvius that he takes it up in ch. 22 (16), 5: "Non enim omnia eisdem rationibus agi possunt, sed sunt alia, quæ exemplaribus non magnis similiter magna facta habent effectus, alia autem exemplaria non possunt habere, sed per se constituuntur, nonnulla vero sunt, quæ in exemplaribus videntur veri similia, cum autem crescere cœperunt dilabuntur."

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[1] It can pull down walls from a height of 70 cubits, and drag on the sides to the extent of 70 cubits. It is worked by 100 men, its weight amounting altogether to 4000 talents.

[2] The machine called *Helepolis* constructed by the Athenian Epimachus, which during the siege of Rhodes was impelled towards its walls by Demetrius, is constructed as follows: it is 90 cubits high and 40 cubits broad; it is shaped like a tower, and can resist blows of stones weighing three talents.

[3] Even so in Chios. The enemies having placed *sambukes* on their vessels, the Chians at night filled up the sea outside the walls with earth, sand and stones. Now, when the enemy approached, the ships stuck in the ground and could neither advance towards the wall nor retire; they remained on the spot, were hit by fire-arrows and burned.

Vitruvius's method of working may have become clear to the reader in comparing it with Pliny's, but it betrays itself even more distinctly when compared with Athenæus. The chapters 19–21 are mere translations, though not always literal. Sometimes a sentence is omitted; now and then the descriptions are drawn out by arguments and irrelevant additions, where the author considered himself sufficiently acquainted with the matter. It is by no means impossible that he may have had something to do with the construction of catapults and similar engines of war—not for Cæsar and Augustus, but some centuries later. That Vitruvius has not merely drawn his knowledge from the same source as Athenæus—as some people have thought—but has plagiarised and in several places literally translated this author may become evident by comparing the texts, even with the misunderstandings we have pointed out above. It appears distinctly from the fact that the similarity is found, not only in the subjects treated by both, but also in the individual remarks, such as the critical observations about Diades having solemnly promised to describe *ἐπιβάθρα* and *σαμβύκαι* without keeping this promise; about the difference between some models and the machines constructed after them; in the remarkable substitution of *φησί* instead of *φημί* (comp. above, p. 35); in his introductory remark that though describing engines of attack, his purpose is only to teach people to defend a fortress; etc. etc.

V.

Now, as we have seen above that not only the language of Athenæus but his own statements testify to the fact that he lived in the middle of the third century of our era, it is evident that the book we possess under the name of Vitruvius cannot be of an earlier date, and that this author sails under a false flag when he dedicates his work to Augustus and tells us that he has served under Cæsar. Now we understand the wide difference between his language and that of Rome's golden age, and all the peculiarities which meet us step by step in reading the book. The dedication at once strikes us as impossible. This non-commissioned officer does not address the emperor by the title of honour, "Augustus," used by everybody else, though his work cannot have been written before the year 27 B.C., when the senate bestowed this honour on the emperor, for he knows the name of Augustus, and he tells us that he himself has built a temple to Augustus. It is altogether impossible that a man who had served under Cæsar could have given a description of the siege of Massilia which is quite contradictory to the detailed report given about this event by Cæsar himself, and that he could tell us the attack was repulsed, while all the world knew that the town had been obliged to surrender. It is quite incredible that at a time when the worship of Isis was forbidden in Rome, it should be considered a necessity to have a temple of Isis in each town, and to have a place set apart for this purpose. But we will not repeat all the circumstances to which attention has been drawn in the second chapter; we will only emphasise one point more. It is incomprehensible that a Roman who wrote about architecture at the time of Augustus did not allude with a single word to the marvels of architecture constructed at that period, and that if he wanted illustrations he did not choose them among the works that were known and admired by everybody, instead of referring to buildings from the time of the republic. The only explanation is that his book is modelled on a work which was written before the reign of Augustus. Such an *opus* existed, as we know, in Varro's *De Architectura*, which, accordingly, we are justified in considering as the principal source of Vitruvius. The man—as we have seen—was no real architect, but confessedly an amateur who had read some books about these matters, and therefore considered himself called upon to teach others. However, not expecting that his book would be successful when published under his own name, he preferred to borrow an older well-known name. A work from the classical Roman period reappearing after having been lost would be seized upon with avidity, and its publication might prove a lucrative business.

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[1] He did not understand that there are things which look well in small models, but cannot be carried out in large size, while there are others which cannot be represented in small models, but must be worked out at once in their due size.

There are instances enough of such frauds in recent as well as in ancient times. In Greece, shortly after the death of Plato and Demosthenes, forged letters and speeches were attributed to them. A counterfeit letter from Philip to the Athenians was passed off as genuine, another from Themistocles, several ditto from Phalaris, and many others. The alleged Dictys from Crete and his successor Dares the Phrygian, who pretended to have lived at the time of the Trojan war, related the history of this war, faithfully, as they said, in omitting all the fables with which Homer had embellished it. The Romans were not second to the Greeks. The letters from Cornelia to her son Caius Gracchus are very suspicious, and as for Cicero's speech *antequam iret in exilium*, the epistles from Sallust to Cicero, Sallust's invectives against Cicero, and the latter's reply, everybody believes them to be forgeries. A booklet of much later date on the art of cooking, *De Re Coquinaria*, goes under the name of Apicius, a famous gastronomist of the time of Nero. We conclude by quoting a case quite analogous to the one exposed in these pages. The translator of the History of Troy by Dares the Phrygian calls himself Cornelius Nepos and dedicates his work to Sallustius, exactly as the author of the ten books about architecture calls himself Vitruvius and dedicates his work to Augustus.

PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
LONDON

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Lv 35.129.5
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